HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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THIS MONTH'S COVER

Robert A. Lawder, in his article on page 85, decribes the heating controls and circuits installed in the readiant heated apartment house at Madison Avenue and 87th Street, New York City. Cover photograph, courtesy of City Investing Co.

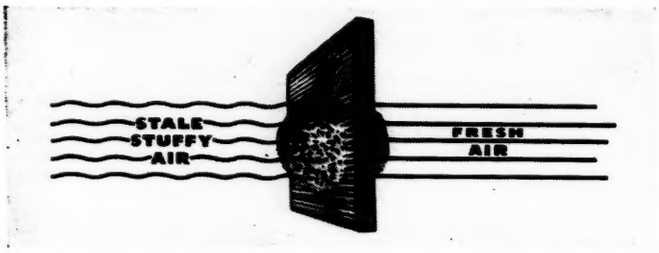
Three air conditioning problems that Air Recovery can solve

1. When the heating and cooling equipment cannot handle enough ventilating air to supply the fresh air demand.

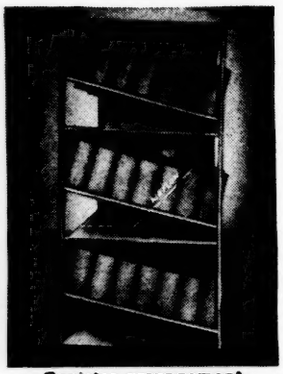
2. When adequate ventilation requires bringing in large volumes of outdoor air *which has to be conditioned at considerable cost.*

3. When it's difficult to bring in outdoor air or when the intake air isn't sufficiently *odor-free* for adequate ventilation.

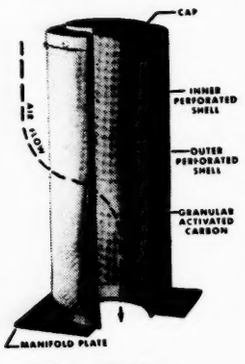
Actual installations show solutions—demonstrate how Air Recovery cuts costs



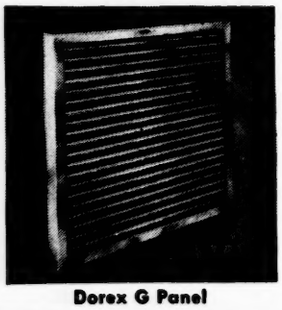
It works like a sponge. The air circulates through beds of specially processed Dorex activated carbon, which literally soak up the most minute traces of any odors originating from occupants and their activities, foods, beverages, tobacco smoke, machines and kindred sources. Thus, recirculated air, already heated or cooled, is restored to original freshness, making it acceptable for human consumption or industrial processes. Average resistance to air flow added by Dorex Units is about 0.15″ water gauge, a negligible percentage of a system.



Canister arrangement



Dorex Canister



Dorex G Panel

Dorex types and sizes have been developed to fit all standard air conditioning installations. G panels are used where space is limited and in unit air conditioners. Canisters are installed in the duct of central station type of air conditioning systems.

IN THIS MAGAZINE in April '48, we described how the majority of railroad companies solved the first condition mentioned above. In June, we reported how the second condition was overcome in the Criminal Courts Building, New York. In the present case, the engineers improving the air conditioning for the First National Bank Building, Detroit, were faced not only with the third condition, an intake air odor problem, but with the first as well—the cooling equipment could not handle enough ventilating air to supply fresh air demand.

The solutions to these problems illustrate where, how, and why you can profitably design Dorex Air Recovery Equipment into similar high occupancy jobs.

Even though the outdoor air intake of the First National Bank Building is located at what is ordinarily a good position on the fourth floor level, it was befouled under certain wind conditions by kitchen exhausts from several neighboring restaurants. In addition, business in the bank had increased. Added personnel and customers created a ventilation demand that overtaxed the existing conditioning equipment to a point where the operators had to choose between desirable temperature and proper ventilation. At times, it was necessary to bring in a maximum amount of air for dilution purposes. You can imagine the spot they were in when cabbage smells were coming their way.

The application of Dorex in a case like this is simple. Since it is a problem of ventilation—and that's a problem of odors—remove the odors. That's just what the engineers did.

They installed enough activated carbon canisters to purify 20,000 CFM of return air and 10,000 CFM of outdoor air. The 30,000 CFM of fresh air provided ample ventilation. (See before and after installation sketches.)

Since the existing conditioning equipment could handle the 10,000 CFM of outdoor air easily, this solution not only eliminated the need for additional conditioning equipment, but saved on operating expenses as well. In February, before the first heating season with the Dorex equipment was over, Merle Bennett, the Chief Engineer of the First National Bank, reported that he had already saved 108 tons of coal and

Washington News

LORING F. OVERMAN

ONCE upon a time, Washington was a city, not a force. Republicans lived here most of the time, with Democrats taking up residence intermittently. And no one had to subscribe to one or more Washington Newsletters in order to keep posted. It just didn't matter too much.

For 16 years, all that has been changed. And regardless of the winning political party in November, it is unlikely that either business or the individual can ever be unconcerned about things in Washington.

Variable as Weather

Washingtonians have never forgotten the late Will Rogers' comment: "If you don't like Washington weather, wait five minutes." How right he was! Weather Bureau reports are changed hourly. And woe to those who sally forth at noon, dressed as dictated by the 10 a.m. forecast. The wind may have shifted with the passing hours.

Similar are the trials of business and professional men as they attempt to follow the pointings of the business weathervane that revolves around Washington. Illustrating the point are a couple of recent comments about the possibility of an oil shortage next winter.

Oil Shortage? No! Perhaps!

On July 19, Washington learned through the National Petroleum Council that an improvement in tanker facilities will make Government controls over oil unnecessary during the coming winter. The good news was based on the report that 171 more tankers of U. S. and foreign registry will be available at the end of this year than were in service during the winter of 1947. "The world availability of tanker tonnage," said the Council's report, "should balance demand for at least the coming 12-month period."

Oil burner manufacturers who saw the report heaved a sigh of relief, and began to think in terms of expanding production and authorizing salesmen to put on the pressure.

Then on July 23 one General Lucius Clay dropped in on Washington from Berlin; asked for twice the number of planes to operate the German supply lift, and American Petroleum Institute officials did some quick figuring. Prior to the report that added tankers might ease the supply situation, the Institute had estimated that domestic fuel supplies might be some 100,000 barrels short of requirements. Faced with new demands for aviation gasoline to meet an unexpected emergency, Institute officials observed, "The domestic situation is tight, and when you increase purchasing in any quarter, it just has to come from somewhere else."

Thus the best laid plans of the oil industry must be changed by requirements "from Washington." In a telegram to 15 major oil companies requesting bids for the additional supplies, the Armed Services Petroleum Purchasing Agency said, "the present crisis in Berlin has created a demand for greatly increased quantities of aviation gasoline in Europe, and the armed services urgently require 900,000 barrels "of high test fuel during July, August and September, in addition to previously stated requirements. The agency added that an additional 500,000 barrels would be needed during October, November, and December. A request for 500,000 barrels to be staggered over the next six months had been received previously.

Steel Allocation Deferred

Another change that took place during the short Congressional adjournment was the decision not to use, for the present at least, the authority conferred upon the Administration by Congress through the Ploeser amendment to the Draft Act. As June ended there was much speculation as to just how far the "draft industry" amendment could be stretched if the Government desired to use it to allocate steel and perhaps other scarce materials.

Apparently it was decided to use the allocating power as more of a club than a slingshot, for there has been a noticeable stepping up of interest and participation in "voluntary allocation programs" being sponsored by the Office of Industry Cooperation, Department of Commerce.

To date, segments of the heating and ventilating industry are beneficiaries of this plan to the tune of 233,000 tons of steel products for use in the eight months starting July 1, for the production of warm air heating equipment. Approximately 450 individual manufacturers are eligible to share in this set-aside.

On July 20, Secretary of Commerce Sawyer announced approval by the Steel Products Advisory Committee of a proposed voluntary agreement to provide 105,273 tons of steel products monthly through February 28, 1949, to meet requirements of the armed forces. This would provide steel products at the annual rate of 1,269,000 tons, which is the amount designated by the armed forces as necessary to carry out programs approved for the fiscal year.

Also approved—subject to public hearing on August 4—was an allocation of 16,529 tons of steel monthly for the same period for the oil field tank and production equipment industry. Included are materials for oil and gas separators, heaters, emulsion heaters, bolted storage tanks, and welded production tanks for use at well heads.

Other allocation proposals approved would allot 20,000 tons of steel monthly for the production and repair of wet and dry cargo barges, and 2,500 tons monthly to the anthracite coal industry for maintenance and repairs necessary to maintain full anthracite production.

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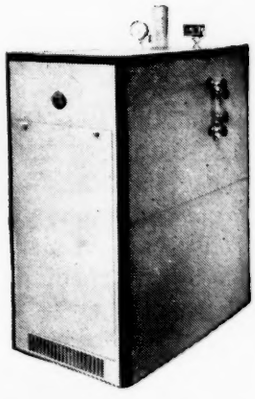

Inside . . . this Heart of Steel

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OVER 75 YEARS BOILERMAKERS

Small Business Needs

In discussing a proposal for a more equitable distribution of steel products intended principally to alleviate small business hardship cases, the Steel Products Advisory Committee passed the following resolution:

"It is the sense of the Steel Products Advisory Committee that all points covered by OIC's 'Suggestion for Possible Voluntary Methods of Promoting Equitable Distribution of Steel' are now, to whatever degree is practicable, being carried out, and the individual members of this industry committee will continue this practice. We agree with the objective proposed but cannot agree to be bound by a specific set of regulations which cannot possibly provide for all the variables which need to be considered in any individual allotment program."

Observers in touch with the snowballing progress of the voluntary allocation program comment that the idea may work to the satisfaction of the early birds for a while, but that if it should become definitely apparent that there will not be enough steel to go 'round, the picture will be much different.

At such a time, the Government might decide that it will be necessary to use the mandatory powers granted by Congress, even though these apply, theoretically, only to military purchases. It is anticipated that many small users would be squeezed out of the supply trough by others enjoying a voluntary allocation plus a mandatory military allotment. In such an event, Congress would be pressured for an overall control order reshuffling the visible supply to give all a crack at the total.

If voluntary allocations continue at present rates—with huge programs for ship-building, petroleum transportation and gas lines still under consideration—a marked shortage during the last quarter of 1948 and into 1949 seems likely. Offsetting factors would be to increase total 1948 production to at least 68 million tons (3,000,000 above 1947); increased production of steel in western Europe, and a paring down of voluntary programs. It is hoped that some 750,000 tons slated for export to Europe can be saved, and that the requested allotment of 7 million tons to the oil and gas industry can be shaved. The latter, it is said, must be trimmed if the entire program is to be kept anywhere nearly balanced.

Basing-Point Pricing

Adding much to the confusion in the steel picture are changes in the method of pricing steel. The problem centers upon the recent action of the United States Steel Corp. and others in dropping a system whereby customers at a distance and those near mills paid the same prices for steel. Action of the steel companies followed a decision, announced in April by the Supreme Court, that a similar pricing method used by the cement industry violated Federal Trade Commission regulations and the Clayton Act, as amended by the Robinson-Patman Act ban on price discrimination.

Unless Congress specifically legalizes the former method of computing prices from so-called base points, steel plants will use the f.o.b. system. The effects of such a change upon users of steel products are marked, for customers at a distance from sources of supply will pay considerably more for steel. Similarly, those close to mills will pay the lowest prices.

Steel companies are said to be anticipating that users will put up such a howl that Congress will hear, and act. Steel companies may do a little prompting, but it is expected that they will take little part in actual efforts to have the Supreme Court position clarified. They appear content to comply, while their customers complain to Congress.

It has been pointed out that the entire economy of the nation could be changed by this shift in pricing methods, with steel users moving their plants nearer to mills, or mills decentralizing to serve present customer plants. More likely, many feel is the possibility that Congress will take clarifying action early in 1949. Although the change in the steel pricing situation will be reflected almost immediately in changes in the price of finished products and components, physical changes involving plant location are expected to be minor. Most, it appears, prefer to wait and see whether there'll be a change in this particular Washington weather.

Congress Again

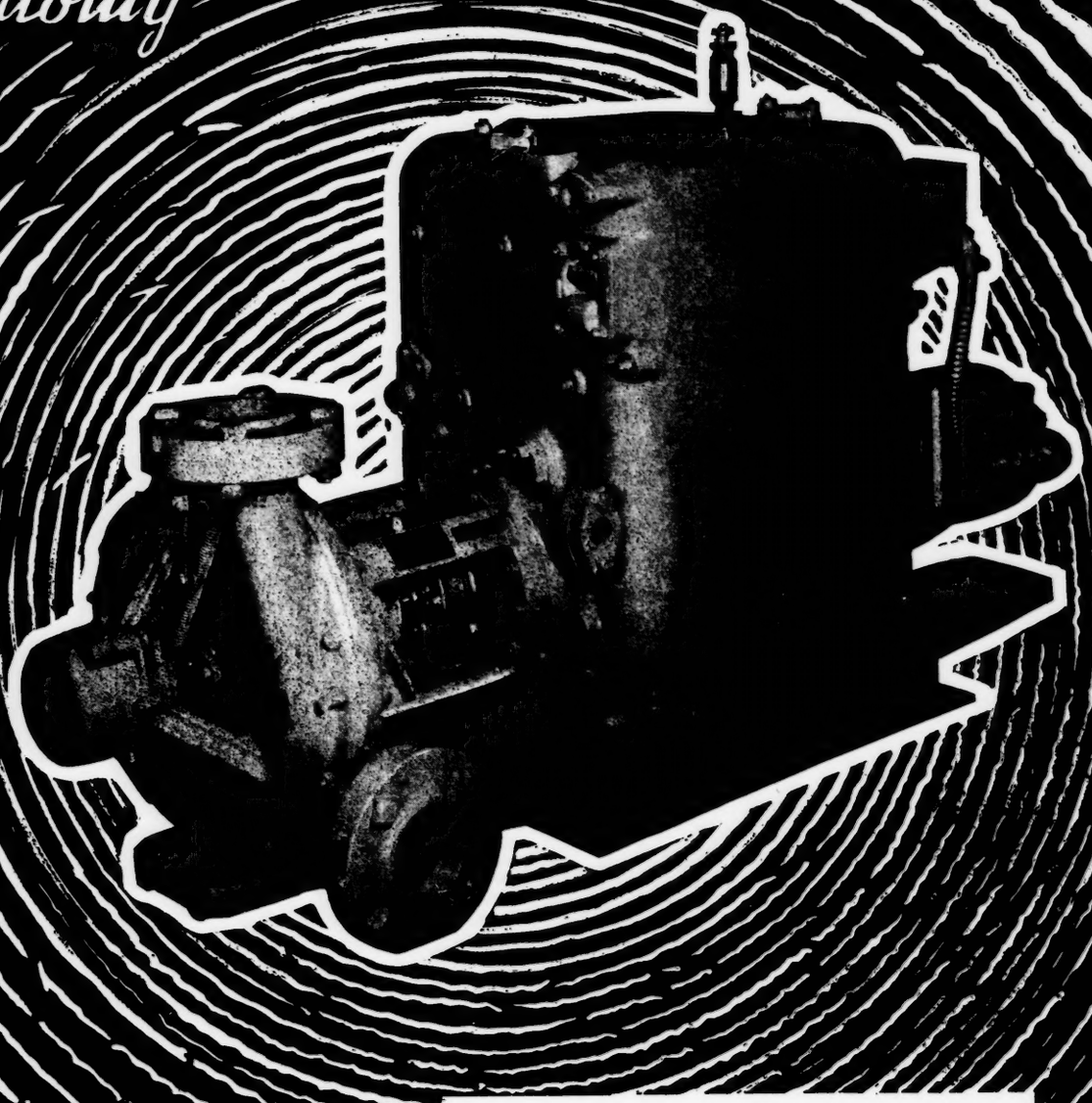
Speaking of changes, there is a growing sentiment in Washington that some changes are just going to have to be made in the present price structure. Things simply haven't worked out as Congress thought they would, and as business promised, following the removal of price controls. Prices and wages have chased each other through three spirals since then, and millions of persons on more or less fixed incomes are finding the pressure unbearable.

Major trouble seems to have been the basis upon which wage and price controls were freed did not follow the anticipated pattern. Instead of Government retiring from the picture as a major purchaser, it stayed in the market, building demand upon demand, price upon price, and wage upon wage. Government's part as a customer involves expenditures of some $40 billion a year, much of this total unanticipated at the time price and wage controls were discontinued. Such expenditures as $7 billion for European aid, and $13,000,000 for armament were undreamed of when elimination of controls was under discussion; yet these items are largely responsible for the upward pressure on prices and wages.

About the last thing the 80th Congress wants to do is reverse its position on prices and wage controls, particularly with President Truman chanting, "I told you so." But there's another thing the Congress doesn't want to be accused of, either, and that is of being unable to change with the times. So as the 80th Congress convened in special session, betting was that if nothing is done about price and wage controls by this Congress, it will have to be done by the next.

Alternative to some sort of a brake is to "let her climb and watch her fall," which is exactly what a new Congress will not want to happen.

Centralized Heating Economy



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Air Conditioning

HEATING AND VENTILATING

E. J. KUREK

Engineering Department, The Greyhound Corp.

In view of the low cost of bus transportation and the appeal of highway touring, comfort air conditioning has become a critical factor in promoting bus travel. Besides, many states have set minimum heating and ventilation requirements for public carriers. Design problems are covered in this article, and a description given of an experimental air conditioned bus.

PROBLEMS encountered in the designing and installation of bus air conditioning systems are far from simple. Ducts are almost always relegated to what might otherwise be waste space. Air is forced into spaces as between roof skin and ceiling, double walled package racks, seat beams, and under decking. Such ducts, frequently lined with insulation, traversed by various structural members, obstructed by reading light fixtures, and other factors defy prediction.

Heat exchangers, refrigerant compressor, heater, and associated equipment are generally installed at the expense of premium baggage space. The compromise is seldom favorable. The very essence of low cost operation is the maximum use of equipment. Hence component units must not be an undue burden on hard pressed maintenance crews. The vibration conditions, diverse climatic environments on long distance runs at various altitudes, and the limited power supply of bus generators complete the enumeration of difficulties.

The modern coach has an ancestry in common with the present day automobile. Quite expectedly then, its initial air conditioning problems were solved in a similar manner. Ventilation was provided via windows; surplus engine heat provided warmth. The evolution of the coach from an oversize automobile or small truck to a true bus in the modern sense necessitated the development of forced air heating. Most inter-city buses use this type of system today. Adequate ventilation is provided by blowers. Hot water is taken from the engine coolant system but energy is available only in the amount that is required to be disposed of for efficient engine operation. This quantity may or may not conform to ventilation requirements.

The development of refrigeration for bus air cooling brings us to the advent of what in non-technical language is the air conditioned bus. The Greyhound Silversides is a typical example. The use of cool-running diesel engines presented the problem of very little waste heat at certain times. The difficulty was overcome by the installation of a diesel oil burning water

heater, a suitable water circulating pump, and automatic controls. Use of the heater on standby operation, when the coach is secured in a parking lot during cold weather, obviates the use of anti-freeze solution in the coolant system and keeps the engine warm for easy starting.

The Greyhound GXI-50, or The Highway Traveler, represents the latest step forward. This bus, recently completed and now undergoing exhaustive road tests, is an experimental coach of radical design. Powered by two air cooled aircraft engines, it embodies aircraft construction to the greatest extent compatible with its function. The saving in dead weight is utilized to carry a greater pay-load more luxuriously. The lower deck accommodates 13 passengers, a lavatory and water cooler. The driver and 37 passengers ride in the upper deck. Individual head rest radios provide each passenger with a choice of one of two programs. In keeping with the general atmosphere of comfort, an attempt has been made to provide an outstanding air conditioning system.

Specifications

To the attainment of this goal, it was decided to render the system as fully automatic as possible to relieve the driver of responsibility for its correct functioning. Adequate heat, ventilation and cooling were, of course, stated as the primary objectives. A simple ventilating sequence was added to the theoretical cycle of operation to take advantage of free evaporative cooling when atmospheric temperature permits. Since, in the past, passengers had almost universally complained of feeling chilled after sunset, constant bus temperature notwithstanding, it was elected to incorporate an elevated night temperature feature in the control system.

Calculation of Requirements

The basis for estimating bus heat loads is empirical. The mobility of the coach makes any attempt at a detailed theoretical solution of the problem impractical especially in view of the ease and economy with which experimental results can be attained.

Since maximum coach dimensions are specified by law, there is no great variation in the design of buses from a heat transfer point of view. Even in the case of the Highway Traveler, the principal dimensional change from the preceding Silversides is an increase in height of only 11 inches in a total of 134 inches. In general, the heat loss calculation represents an estimate of conduction losses to which the heat required to warm fresh air is added. It is estimated that the total heat requirement of the Highway Traveler will be about 73,400 Btu per hr at —20F ambient air temperature.

Air cooling capacity is more severely limited by space and/or power restrictions on the various components of the refrigerating system. It becomes evident that the system allowable is smaller than that which is desirable. Therefore, it is necessary to be willing to accept the fact that beyond an experimentally determined atmospheric wet-dry bulb condition, it will be possible only to lag outside temperature by a fixed increment. Past experience with the Silversides gave an indication that from 5 to 7.5 tons of refrigeration would be required.

It was decided that the maximum allowable temperature differential between air supplied to the coach and the return air should be 7F. On the basis of this decision, and the expected coach heat loss, an air volume of 1,800 cfm was arrived at, 600 cfm to be fresh air. During the simple ventilating sequence an initial volume of 3,000 cfm was agreed on for testing.

Heating the Coach

Heating the GXI-50 is accomplished by a gasoline fired water heater and circulating pump, suitable piping, and two heating coils.

The heater, expressly designed and built, has an output capacity of 150,000 Btu per hr. Completely automatic, the closing of a permissive switch by the air conditioning step controller initiates a cycle of events in the heater control which includes a period of electric ignition followed by full capacity operation modulating, as water temperature changes, between full fire, half-fire, combustion chamber purge, and full off. As long as the permissive switch is closed, the hot water circulating pump is in operation and the heater will automatically provide water at the temperature set. When the heat requirements of the coach have been met, the permissive switch opens, de-energizing the pump motor, stopping the fire and purging the combustion chamber for a fraction of a minute. The permissive switch is a switch on the step controller which is wired in to the hot water heater control circuit so that with the circuit energized, the operation of the heater depends solely on water temperature. Without this switch in the circuit, the heater would attempt to maintain the water in the heating coils at say 190F despite the fact that no heat might be required.

The heating coils are adjacent to the cooling coils and immediately in the blower suction. Fresh and recirculated air mix in the plenum chamber, pass over the cooling coils, through the heater coil and to the suction sides of the blower. The air cooled gasoline engines obviously have no liquid cooling system so that the heater is the sole source of heat and does not serve any collateral functions as in the case of the Silversides. To prevent damage due to freezing when the system is secured, a heat-carrying medium of 50% water and ethylene glycol is used. The total liquid capacity of the system is about 3 gal.

Cooling

A two-cylinder, five-ton Freon compressor operated at slightly higher than design speed to give 6 tons refrigeration, is the power consuming device of the cooling system. In addition to providing Freon for the air cooling evaporator coils, the compressor must carry the heat load of a 5 gal drinking water tank and a small beverage cooler. This compressor is driven by the accessory drive transmission. A small air piston activated by a solenoid air valve which opens when

energized engages the compressor drive clutch. The Freon condenser cooling fans are belt driven from the compressor shaft and operate whenever the compressor does. Heat generated by the Hydrotarder dynamic brake in long down grades where conventional brakes are impractical, is dissipated through a radiator located on the discharge side of the right hand condenser cooling fan. Air drawn over the condenser is pushed through the Hydrotarder radiator before being expelled to the atmosphere.

It is evident that under certain conditions it may be necessary to operate the cooling fan for the Hydrotarder radiator when no air cooling is required. Or, it is conceivable that the water cooler and beverage compartment may call for cooling when the Hydrotarder is not in operation and no air cooling is required. To this end, the Hydrotarder fan switch was installed, a micro-switch which closes by a cam action when the unit is engaged. The suction pressure switch closes when the low side pressure exceeds a predetermined limit. The sole function of the Hydrotarder fan switch is to engage the refrigerant compressor, hence the fan.

An increased heat load in the water cooler is reflected in a higher suction pressure which ultimately closes the suction pressure switch and energizes the water cooler relay. The effect is to engage the compressor even though both of the other relays are inactive and to de-energize the by-pass solenoid valve permitting Freon to flow to the appropriate cooling coils.

The air cooling relay, when energized by the air cooling switch, not only engages the compressor and closes the by-pass, but opens the air cooling solenoid as well, permitting the thermal expansion valves on the evaporator coils to regulate the flow of Freon for air cooling.

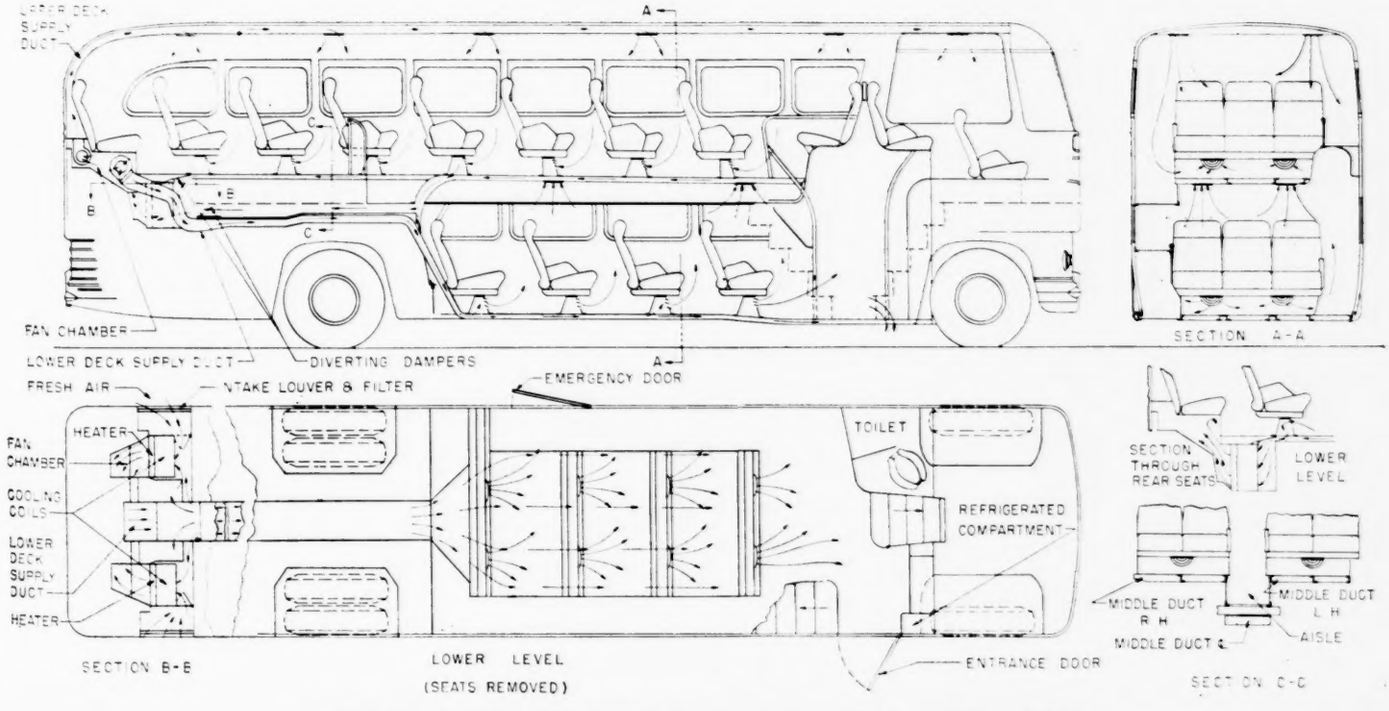
The operation of these three switches can take place in any sequence or combination without detriment to the functions served by any. The high pressure cutout is a compressor safety feature and is wired to override the other switches.

Air Movement

Movement of ventilating air takes place through three general areas: In the roof of the coach; between the two decks; and under the floor of the lower deck. Entry into or out of the passenger compartments is effected by air diffusers built into the seat supporting beams and ceilings of the respective spaces. The fresh air intakes, filters, heating and cooling coils, diverting and fresh air dampers are located symmetrically about the coach centerline at the rear. Two sets of blowers located aft of and above the heat exchangers draw air over them and discharge it into the upper deck supply duct, the lower deck supply duct, and the middle duct.

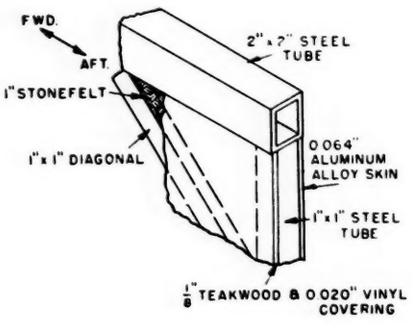
Diverting dampers are arranged in such a manner that air discharged into the middle duct (left hand and right hand) can be blocked, simultaneously connecting the forward portion of this duct to the mixing chamber, making it an exhaust duct. When the dampers are reversed, the blowers are unblocked, the duct is sealed from the mixing chamber, and the middle duct, l.h. and r.h., becomes a supply.

The middle duct-centerline opens into the mixing chamber and acts as an exhaust. When the diverting damper between it and the lower deck supply duct is reversed, the middle duct is sealed from the mixing chamber, takes some air from the lower deck supply and thereby becomes a supply duct itself. The middle duct l.h. and middle duct-centerline merge forward of the rear of the lower deck passenger compartment. The dampers are connected by a linkage which insures that in operation the three branches of the middle duct serve together as either supply or exhaust passages.



Details of ducts and air flow for a Greyhound air conditioned bus.

The upper deck supply duct provides a constant volume of air. The quantity of air carried by the lower deck supply duct is a function of the lower blower assembly speed and the diverting damper position. With diverting dampers in the recirculating position, and associated blowers at low speed, the



Detail of sidewall construction for an air conditioned bus.

middle ducts exhaust upper and lower decks. The lower deck supply carries 600 cfm to the lower deck. With blower speed constant, change of diverting damper position changes the function of the middle duct to supply so that the upper and lower decks received 1,600 and 800 cfm, respectively. An increase in blower speed brings 1,800 cfm to the upper and 1,200 cfm to the lower deck for the simple ventilating sequence. Under these circumstances the air is exhausted to the atmosphere through openings in the forward end of the coach.

Blower speed increase is effected by shunting out external resistance at the signal of a micro-switch on the step-controller.

Control

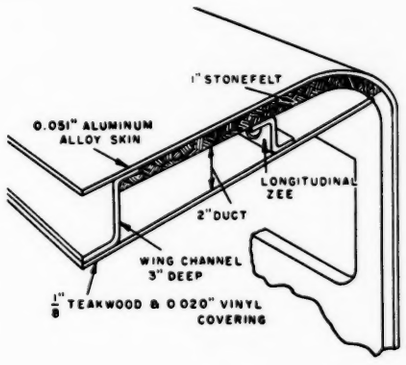
Pneumatic electric controls operate the various units in proper sequence. The sensing element, located in an air stream between the coach and mixing chamber, translates coach temperature into vapor pressure within the bulb, and associated capillary tube and bellows. Any change in vapor pressure, i.e., coach temperature, causes a disruption of the equilibrium between the bellows and its balancing spring. The resultant movement to a new equilibrium position actuates a linkage which bleeds air either into or out of a pilot air circuit. The air pressure in this circuit varies from 0 to 17 lb per sq in. over a 6F coach temperature rise, thereby providing for a complete cycle of operations from heating, through simple ventilation, to air cooling within the same range. Branches of the pilot air circuit and 17 lb per sq in. air lines are connected to the air motor of the step-controller. As the pilot pressure varies, 17 lb per sq in. air is bled through a pneumatic relay into or out of the air motor, compressing or expanding the bellows in it, and through a suitable linkage, positioning the cam shaft accordingly. Adjustable cams actuate 6 single-pole double-throw micro-switches to accomplish the control sequence.

The outside air proportioning dampers are supplied with an air motor of the same type as the step-controller but adjusted to be inoperative until the pilot pressure reaches 5 lb per sq in. The air motor modulates the dampers from closed to full-open with a pilot pressure increase of about 1 lb per sq in. When air cooling begins, a three-way solenoid valve in this branch of the pilot air circuit is de-energized, cutting off the pilot pressure while simultaneously bleeding that pressure from the air motor pneumatic relay. The unbalance in the relay releases whatever 17 lb per sq in. air was in the air motor and the dampers snap closed to the new equilibrium position. The power draw of the air conditioning system is such that it would be inadvisable to attempt its operation on batteries alone. Therefore a system has been evolved whereby this circuit is not energized until the generators, powered by an auxiliary engine, come up to voltage.

The following sequence of operations takes place, assuming an initially cold coach is brought ultimately into an atmosphere which requires cooling for passenger comfort.

Heater and coach are cold, all circuits are de-energized, and the auxiliary engine begins to rotate the generators. When the generators develop 14 volts, a relay cuts all air conditioning circuits into the generator bus bar. The ventilation blowers begin to turn over at low speed. The heater ignites and goes on high fire at the same time that the water circulating pump begins moving water through the heating coils. The heater output modulates until the coach temperature approaches the thermostat setting. When the heater permissive switch is opened by the step-controller, the heater, if in operation, immediately purges and goes off. With diverting dampers in the recirculating position and outside air dampers at minimum opening, 1,200 cfm of recirculated and 600 cfm of fresh air are supplied to the coach.

As the coach temperature continues to rise, the pilot air pressure reaches 5 lb per sq in., at which time the outside air dampers begin to open, admitting an increasingly greater proportion of fresh air until almost all of the 1,800 cfm of air is fresh.



Detail of roof construction to show insulation and duct.

If the temperature continues to rise the step-controller opens the diverting damper solenoid valve, causing a small air piston to snap the diverting dampers into the non-recirculating position. Without varying blower speed, the system begins to deliver 2,400 cfm of fresh air.

As the cam shaft of the step-controller rotates with increasing coach temperature, the third micro-switch

closes, energizing a relay which places one set of blowers in high speed operation to give 3,000 cfm of fresh air to the coach.

If evaporative cooling is insufficient, the camshaft continues to rotate, reducing fan speed, hence delivery, to 2,400 cfm of fresh air. Further temperature rise energizes the Freon compressor clutch, returns the diverting dampers to recirculating position with 1,800 cfm fresh air and then closes outside air dampers to the 1,200 cfm recirculated, 600 cfm fresh air condition, in that order.

A second bellows which operates in sympathy with the balancing spring of the thermostat is inoperative during daylight hours. The instrument panel switch by means of which the bus driver energizes the coach outside marker lights also energizes an air solenoid valve. This valve when open permits air to pass through a pressure reducing valve and into the subject bellows causing an unbalance which is compensated for by increase in coach temperature. The magnitude of the temperature increment is a function of the reducing valve setting.

Summary

Much work remains to be done in the field of bus air conditioning. The bus air conditioning engineer, while handicapped by the restrictions discussed, is fortunate in having the opportunity to do extensive experimental work. He has an excellent and inexpensive proving ground for his ideas in the pilot model.

Efficacy of the various design programs depends on complete records and tests of existing equipment since it is on this basis that many of our problems must be solved. It appears that few fields offer as wide a range of experience to the engineer.

Coking Coal Survey Started by Bureau of Mines

A nationwide survey of minable coking coals to serve as a guide in developing adequate reserves for use in times of national emergency has been launched by the Bureau of Mines. Beginning in sections of Pennsylvania, West Virginia, Kentucky, Tennessee, and Alabama, the survey will extend to every coal-producing state. A shortage of coking coal—vital to iron and steel production— developed during the war and has become more acute with the record level of peacetime steel production.

Assisting the Bureau in the survey is the Coal Resources Committee of the National Bituminous Coal Advisory Council. The Coal Conservation Committee of the Council also is working with the Bureau in a companion program to extend the supply of coking coals through washing and blending studies.

The survey will gather information from private, state and Federal sources to go into the final estimate of coking coal reserves. No reliable and comprehensive estimate of such reserves now exists, although there are estimates of reserves in a few specific areas.

Simultaneously, the Bureau of Mines will step up its research in blending coals and up-grading submarginal coals to augment the coking coal supply, and expand its investigations of coal reserves in Alaska. All of this is a part of a program for which Congress appropriated $450,000 for the current fiscal year.

According to James Boyd, director of the Bureau, "Before Government and the industry can attack the problem of diminishing coking coal reserves intelligently some reliable and authoritative estimate of the current situation must be obtained. Existing estimates of reserves in certain areas are out of date, the basic figures from which they are taken are not known to be authoritative, and they are not capable of being adapted to present-day terms of depletion and discovery. There has been no systematic inventory of our coking coals based on recent information. A critical re-examination is needed."

While the coking coal survey is going on, the Bureau, in pilot plants and laboratories at Pittsburgh, Pa., and other stations, will study ways to remove sulfur and other impurities from coal which otherwise could be used for making coke. They will also study the blending of highly expanding coals with other coking coal to make blends safe for use in coke ovens. Submarginal, or low-grade, coals will be blended with other coals to produce metallurgical-grade coal, and the highly expanding and submarginal coals will be added to the final coking coal estimates.

In Alaska, where coal production has never kept up with demands, the Bureau will expand its drilling in a large bituminous deposit in the Wishbone Hill area, southwest of Jonesville in the Matanuska Valley section. Here, a preliminary investigation by the U. S. Geological Survey and the Bureau of Mines has shown substantial reserves of coal. Examination of areas on the Kenai Peninsula near Homer, and other promising localities, will be undertaken this year in preparation for core drilling later. During World War II, shipping difficulties and an increased demand for coal created a fuel shortage in Alaska, showing a need for developing additional minable reserves, especially of higher-grade bituminous coals.

The seriousness of the coking coal situation in the United States was emphasized in 1944, the peak year of the war. A total of 105,000,000 tons of coking coal were used that year. Consumption dropped to about 83,000,000 tons in 1946, but has since increased to 100,000,000 tons annually for making iron and steel.

Design of Earth Heat Source Systems

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Acting Director of Research, Research Professor of Mechanical Engineering, College of Engineering, New York University

There is general agreement that, if an economical means of heat transfer can be developed, a heat pump utilizing heat from the earth would be both simpler and cheaper than one utilizing air in regions where low air temperatures are encountered. Information available on the design of earth heat systems is meagre, and experimental data are limited This article considers some of the factors involved in the design of such systems and discusses possible ways of simplifying their design.

UTILIZATION of the earth as a source of heat presents some rather difficult problems. In order to obtain high coefficients of performance in heat pumps, it is necessary to maintain low temperature differentials between heat source and space to be heated. The fact that earth itself is a very poor conductor of heat, combined with the relatively long distance through which the heat must be conducted, makes it necessary to use extensive amounts of heat transfer surface. Another difficulty is in maintaining good contact between the earth and the means used to extract heat.

Basic Theory

Fig. 1 shows a simple type of earth heat exchanger and might represent either a vertical or horizontal pipe of diameter r_1 in which fluid is circulated. A simplified concept of heat transfer within the earth is indicated by the cylindrical section of earth of radius r_2 surrounding the pipe in Fig. 1. If the flow of transfer medium through the pipe is at normal rates, there will be very little temperature difference between the fluid and the outside surface of the pipe. The thin wall and high thermal conductivity of any metal which might be used for the pipe make resistance to heat flow through the wall of the pipe itself negligible under most conditions.

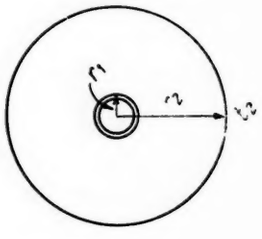


Fig. 1. Schematic diagram of underground heat transfer system in which r_1 is outside radius of buried pipe and r_2 is radius of imaginary cylinder of earth outside of which ground temperature, t_2, is constant.

The equation which applies to the elementary system shown in Fig. 1 is as follows:

$$q = \frac{2\pi k L (t_2 - t_1)}{\log_e (r_2/r_1)} . \qquad (1)$$

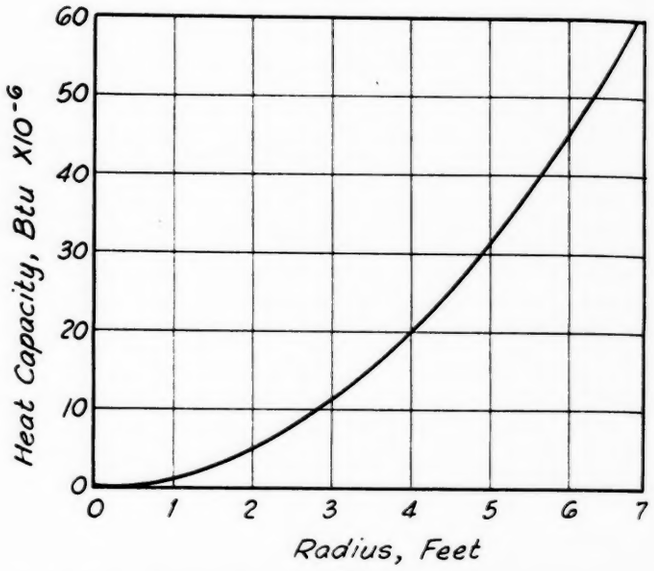


Fig. 2. Change in heat content for a 10-degree temperature change in a cylinder of average earth 1000 ft long and of various radii. Density of earth is assumed to be 100 lb per cu ft and specific heat .4 Btu per (cu ft) (lb).

Where q = Heat flow, Btu per hr
k = conductivity of soil, (Btu) (ft) per (hr) (sq ft) (F)
L = length of pipe, feet
t_2 = source temperature, F
t_1 = pipe temperature, F
r_2 = radius of source
r_1 = radius of pipe

This very simple equation has many limitations. It assumes steady state conditions, that is that the system is operating under uniform conditions. In order to use the equation it is necessary to assume some outer radius at which the temperature is uniform. This obviously requires an approximation, and when this equation is used consideration must be given to these limitations.

Use of Equation (1) requires some knowledge of the thermal conductivity of earth, which is relatively

Table 1 — Average Values of Thermal Conductivity of Soil

Condition of Soil	k, (Btu) (ft) per (hr) (sqft) (F)
Dry	.2 — .6
Moist	.6 — 1.2
Soaked	1.0 — 2.0

low. Since it is influenced by such factors as packing, moisture content, soil composition, and so forth, it is difficult to generalize on values which might be utilized for calculating heat flow. Table 1 shows typical thermal conductivities of soils.

Moisture content and hence conductivity of the earth immediately surrounding the pipe will vary with the direction of heat transfer through the pipe as well as with climatic conditions. For example, when the system is picking up heat from the earth, the lower temperature of the pipe and soil immediately in the vicinity of the pipe will generally result in migration of moisture to the vicinity of the pipe, hence would tend to increase heat transfer rates. However, if the earth is used to dissipate heat as on the cooling cycle, the higher temperature will result in moisture being driven away from the pipe, hence will reduce its effectiveness as a heat transfer medium.

Inasmuch as most heat pump systems will be designed to operate intermittently, the steady state solution of Equation (1) will not apply as an absolute measure. That is, since the heat pump will be on and off, the earth system will never come to complete

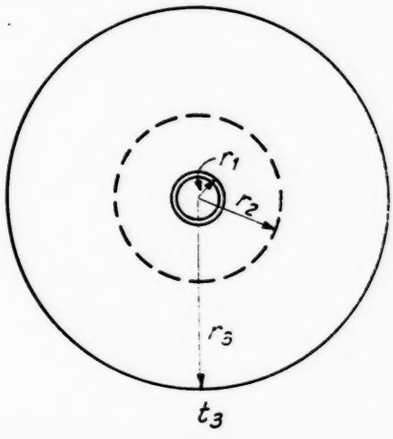


Fig. 3. Diagram of buried pipe where heat must be transferred through more than one medium.

equilibrium. From a practical standpoint, however, unsteady state conditions will usually give higher heat transfer rates than those indicated by Equation (1).

Theory vs. Practice

Experimental data developed at Cornell under C. O. Mackey (H&V:7:47:p71) indicate that heat transfer rates two or three times those calculated from Equation (1) might be expected. In the case of a single pipe buried in the ground, these data show that it would probably be satisfactory to assume a radius, r_2, through which heat will travel, on the order of 100 times the pipe radius. For a 1½-in. pipe a radius of 5 or 6 ft would seem to be satisfactory for the outside radius of the projected earth pickup. In the case of a well using 5- or 6-in. casing, it would be necessary to assume a considerably larger radius. By inspection of Equation (1), it can be seen that increasing r_2/r_1 beyond 100 has a very small and diminishing effect upon q, while decreasing the ratio has a relatively large and unreasonable effect. Decreasing the ratio to its limit, unity, for instance, make q infinite.

As an example of application of Equation (1), consider the case of a system which requires 30,000 Btu per hr of recovery from a heat source assumed to be at a mean temperature of 50F under most severe conditions. The system is to use 1½-in. standard steel pipe (1.90 in. OD) buried in a trench. The temperature on the outside of the pipe is assumed to be 35F under the most severe operating conditions. The problem is to determine the length of pipe necessary to absorb this amount of heat.

If r_2 is 5 ft and k is 1, Equation (1) determines the proper length of pipe to be 1,320 ft.

Any heat source must have sufficient capacity to supply heating requirements over a heating season without pulling down the source temperature. This requirement in part determines what value can be assigned to r_2, and it means that the material within the radius r_2 must have heat capacity sufficient to supply a considerable portion of the requirement over a heating season. Fig. 2 is a plot of change in heat content over a 10-degree temperature change in a cylinder of average earth 1,000 ft long and of various radii.

Transfer Through Layers

Equation (1) gives the basis for calculation of heat transfer within a single medium. In cases where the heat is transmitted through two mediums such as through a layer of ice around the pipe, then soil, as indicated schematically in Fig. 3, the equation for heat flow is

$$q = \frac{2\pi\,(t_3 - t_1)\,L}{\frac{1}{k_1}\ln\frac{r_2}{r_1} + \frac{1}{k_2}\ln\frac{r_3}{r_2}} \qquad (2)$$

where k_1 is conductivity of ice (126), k_2 is conductivity of soil, and t_3 is soil temperature outside the radius r_3.

This equation can also be expanded to include more than two materials. If, for example, calculations are

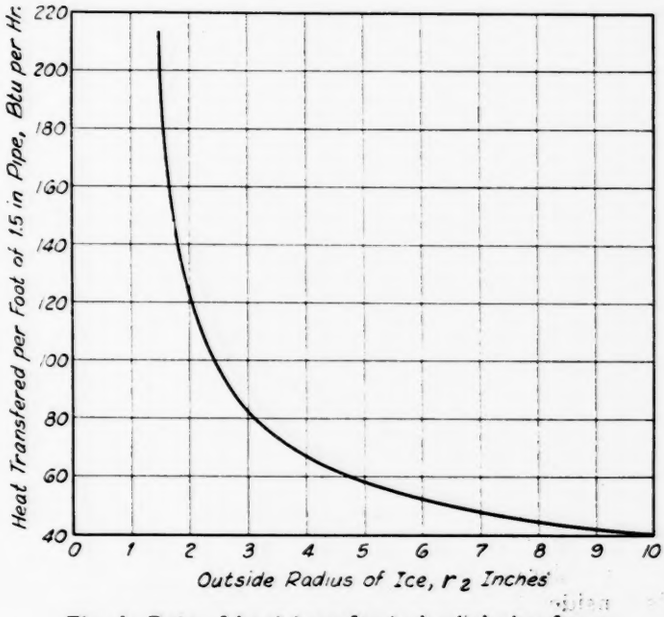


Fig. 4. Rate of heat transfer to buried pipe from surrounding ice of various thicknesses.

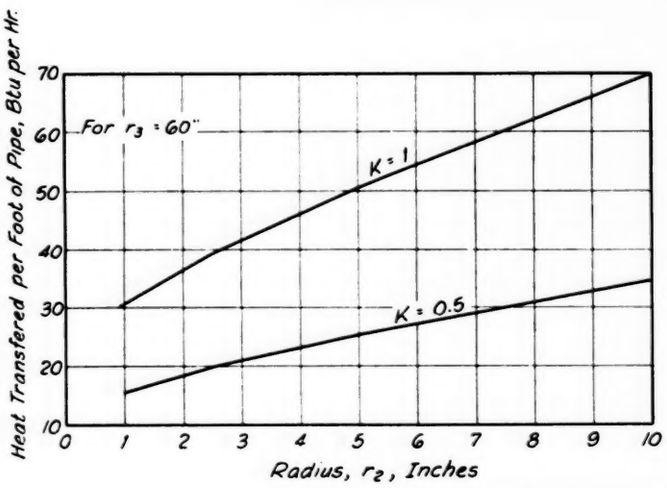


Fig. 5. Rate of heat transfer from cylinder of soil of 5-ft radius (r_3) to various thicknesses (r_2) of ice covering a buried pipe.

made taking into account the wall thickness and thermal conductivity of the steel pipe, it will be found that the effect of the pipe on the heat flow is negligible both because of the high thermal conductivity of the steel and the short distance involved. However, if Equation (2) is applied to the case of a steel pipe surrounded by a small air space and then by soil, it will be found that the effect of the air space is quite appreciable because of the very low thermal conductivity. This indicates one important factor in installation of earth heat systems, that is the necessity of having a very good contact between the earth and the pipe. The following calculation shows that a small air space can considerably reduce the ability of a system to pick up or deposit heat.

Consider, for example, that the earth has settled from around the 1½-in. pipe used in the previous example and has left a ⅛-in. air space. If Equation (2) is solved for L, assuming mean soil temperature as 50F, the temperature at the pipe surface again as 35F, conductivity of air (k_1) to be .013, and conductivity of earth (k_2) equal to 1, we would have a pipe length of 4,320 ft.

This means that over three times the length of pipe would be required because of the air space. While this is a theoretical case, actual conditions could approach the situation described and result in a considerable reduction in effectiveness of the pipe. There have undoubtedly been many heat pump installations where this condition has caused trouble.

Reducing Pipe Length

Because of the considerable length of pipe required by calculation of Equation (1), it is important to study possible means of reducing the length of pipe or of increasing effectiveness of the system. Table 1 shows that one means of keeping the system as effective as possible is to maintain high moisture content since there can be a difference of three or four to one between very dry conditions and very wet conditions. Even under favorable moist conditions, the pipe length is considerable so that under less favorable conditions the situation becomes uneconomical.

There are several ways to improve conditions artificially. Drip systems can be installed which will assure high moisture content. It is also possible to improve pipe-soil contact by surrounding the pipe with some semi-fluid or plastic medium. The use of larger temperature differentials between the earth and the medium used to transport the heat to the heat pump, of course, directly influences the amount of surface required. As this temperature differential increases however, the coefficient of performance of the heat pump will be reduced so that some overall compromise must be used in designing the heat source.

A Possible Solution

There is a limit to what can be accomplished by artificially inducing ideal heat transfer conditions. Even optimum conditions may still result in a designed heat source too large for economical installation. The problem, however, can be attacked from other angles. One is to make some change in the system such that the earth can be tapped continuously for heat, which means that its effective load factor is increased from the seasonal standpoint. Another angle of attack is to install some other medium around the pipe such that high transfer rates can be obtained during the normal operating cycle of a heat pump.

Both of these aims can be accomplished approximately by a modification of the system shown in Fig. 3. In this idealized system the pipe is surrounded by some fluid such as a bentonite clay mud suspension with or without the addition of some chemical which might be used to increase the jell forming characteristics of the mud. This clay suspension or jelled mud is composed primarily of water. If the temperature is reduced below freezing, it will form into ice and the heat of fusion will then be available at the ice surface.

This means that where short periods of operation are concerned, large amounts of heat are available from a relatively small amount of fluid because of the heat of fusion, and further that with only a few inches of ice around the pipe the distance this heat must be transmitted is relatively small. Under these conditions relatively high rates of heat transfer can be obtained.

The operation of such a system is essentially that covered by Equation (2). Inasmuch as the temperature at the ice surface is always 32F, the system will behave as a steady state system, hence Equation (2) will apply more closely than to other systems.

In the case of 1½-in. pipe, as considered previously but with the mud system added, the heat transferred, assuming a 12-degree differential through the pipe itself (assuming 20F mean temperature of fluid in the pipe), is approximately 12,000 Btu per (hr) (ft length of pipe). When a small amount of ice is formed, the rate starts to decrease and, for various radii at the outside of the ice, the rate is given by Fig. 4.

The surrounding earth system will also be under steady state conditions since once ice is formed the earth will transmit continuously to the ice surface regardless of whether or not the heat pump is operating. During periods of heat pump operation, ice will prob-

ably be formed, whereas during off periods ice will be melted.

Fig. 5 shows the corresponding heat transfer from the earth to the ice assuming a 5-ft earth radius and a 20-degree differential between the earth and the ice for two different values of earth conductivity. When it is considered that the heat pump will generally operate only about 40% of the time, the effective heat transmitted from the earth will then be of the order of 2½ times the value shown in Fig. 5. When the effective value of earth-to-pipe transfer, that is the value from Fig. 5 times 2½, equals the value from Fig. 4, equilibrium will be reached.

For example, under the various conditions set up, equilibrium would be reached with an outside ice radius of 2½ in. giving a conduction of about 96 Btu per (hr) (ft length of pipe). Such a system therefore would require only 300 ft of pipe for 30,000 Btu per hr transfer as contrasted with 1,300 or 4,000 ft required in the previous examples.

This system, while it has to operate with a higher temperature differential in order to freeze the mud jell, requires only one-half or one-quarter as much pipe as a system of pipe buried in untreated ground using the same temperature differential. Also the jell system insures adequate contact with the pipe and eliminates possibility of air spaces. In addition it also has storage capacity, which is of importance. While this system has many problems to be worked out, it does appear to be promising.

Procedure for Blowing Off a Boiler

A certain amount of oil and grease must necessarily be used in the machining of boiler parts as well as for the protection of their ground surfaces against rusting during storage, shipping and lying about on the job. Cutting and threading tools also require a good bit of oil as a help to pipe installation, while air valves usually have an emulsion in them when in stock to keep them from turning green and sticking. All this grease serves as a carrier for core sand and other dirt in the piping with the result that a scum of fine particles and grease circulates throughout the system and eventually accumulates on the surface of the boiler water to prevent free steaming. The heavier particles settle out to form a sludge at the bottom of the boiler, but the scum at the water line must be removed through a drain outlet at the surface. This outlet on sectional boilers is left plugged for such use and is located slightly above the normal water line. The blowing off should be done as follows:

Raise the boiler water level to the bottom of the surface blow off outlet, and increase the steam pressure to where it agitates the water enough to keep the impurities in suspension. Drainage of the water by boiler draw-off cock when the water is cold would leave the scum behind and sometimes the settled sludge as well. Keep the surface blow off valve shut until pressure is high enough for blowing, then open it, feeding water slowly to the boiler as required to maintain the outlet level. As pressure recedes or the water line drops too rapidly for normal make-up, close the valve until conditions are right again.

Note that some boilers do not have surface blow off plugs. Such boilers, however, can be blown off by removal of a try cock at the water level, or by providing a tee outlet placed between the boiler and the safety valve.

As a final operation, raise the steam pressure to 10 lb or to safety valve setting, close the surface blow off valve, remove the fire, open the bottom draw-off cock and blow out all water in the boiler by the pressure just raised. Then open all fire and flue doors and when the boiler is cool enough, it should be refilled and flushed a few more times. The entire process may have to be repeated within a week or sooner as more impurities are brought back from the system.

When flushing out a cool boiler, the safety valve can be held open to break the vacuum that is left so that the water will be more quickly drawn off. On the other hand, if the safety valve is left closed, the water will be agitated, churn back and forth, and flush the boiler better as air attempts to enter through the drain and break the vacuum. Whichever method is used, fill up the boiler and piping with water to below first floor radiators, so as to get more head and more water for flushing.

Wood should be used for fuel when blowing down a boiler as it quickly raises pressure and it's fire will soon die out. However, if a coal fire is used, it should be one with a shallow fuel bed so that it can be quickly dumped. All radiator valves should be kept closed during the time that higher pressures are on the boiler, so that pressures can be more easily maintained and so that leaks do not start throughout the system. Often when the condition of the boiler water is not bad, all that is required is to open the drain valve while the boiler is in normal operation, fill the boiler to a slightly higher point on the gauge glass and blow down to a safe water level. This process can then be repeated several times or done once a day for a few days until the water stays clean.

On new jobs it is advisable, wherever possible, to drain condensation directly to the sewer during the first week of operation, with the interior parts of the radiator traps removed, or old trap parts or used air valves substituted the meanwhile. Such drainage should be timed so as to take place ahead of real cold weather, due to the additional load imposed on the boiler by cold water being continually fed to it and by a new structure which is also cold and not fully dried out.—*T. W. Reynolds.*

Determining Heat Transfer Coefficients in Heat Exchangers

WILLIAM PARKERSON
Rate Engineer, Middle Western Service Co., Chicago, Ill.

In response to requests that a means be provided for calculating the numerical value of heat transfer coefficients in liquid-vapor heat exchangers, Mr. Parkerson submits the following amplification of his article, Liquid-Vapor Heat Exchangers, which appeared originally in the December, 1943, issue of HEATING AND VENTILATING with supplementary material in a series of Reference Data sheets ending in December, 1945.

THE starting point for heat exchanger calculations as presented in the writer's original article was the formula for the heat transfer coefficient in a double-pipe counter-flow heat-exchanger constructed of copper tube and having the vapor line on the inside of the liquid line,

$$U = 36C_pG^{.8}\left(\frac{Z}{d}\right)^{.2} \qquad (1)$$

Where U = heat transfer coefficient, Btu per (sq ft) (hr) (F)

C_p = specific heat of the vapor at constant pressure, Btu per (lb) (F)

G = mass velocity of the vapor, lb per (sq ft) (second)

Z = viscosity of vapor in centipoises, and

d = inside diameter of suction pipe in inches.

Now it has been justly complained that, while the elements of *U* were treated in accordance with the article's objective, no actual numerical value for *U* ever emerged from the calculations. Thus it is said that the chief interest of the designing engineer was neglected. Here it is our purpose, therefore, to serve that neglected interest.

In the same article, Equation (1) was converted to the following, more useable form:

$$U = [87.984C_pW^{.8}Z^{.2}] \times \left[\frac{T^{.8}}{d^{1.8}}\right] \qquad (2)$$

which we may write

$$U = X \times Y \qquad (3)$$

The new symbols introduced in Equation (2) are:

W = refrigerant circulated, lb per minute per ton of refrigeration

T = refrigeration in tons.

The bracketed terms in Equation (2), represented by *X* in Equation (3), are those terms which are dependent on refrigerant conditions; those represented by *Y* vary with pipe size and tonnage of refrigeration.

Table 1 — Determination of Values of $X = 87.984\ C_pW^{.8}Z^{.2}$ For Freon-12

Elements in Calculation	Case Number			
	1	2	3	4
Saturated Condensing Temperature, F	110	110	90	90
Saturated Suction Temperature, F	—20	50	—20	50
Heat Content-Saturated Vapor, Btu per lb	75.87	83.78	75.87	83.78
Heat Content-Liquid at Sat., Btu per lb	33.65	33.65	28.70	28.70
Refrigeration Effect, Btu per lb	42.22	50.13	47.17	55.08
Superheated Vapor Temp.*, F	45	80	35	70
Average C_p, Btu (per lb) (F)	.138	.151	.138	.151
W, lb (per min) (ton)	4.737	3.990	4.240	3.631
$W^{.8}$	3.471	3.025	3.235	2.806
Z at midpoint, Centipoises	.01150	.01235	.01143	.01230
$Z^{.2}$	.4094	.4153	.4089	.4149
$C_pW^{.8}Z^{.2}$	.1961	.1897	.1826	.1758
X	17.251	16.691	16.061	15.466
$U = X \times Y$ where $Y = 1$	17.251	16.691	16.061	15.466
$U = X \times Y$ where $Y = 10$	172.51	166.91	160.61	154.66

*Assuming that the vapor is heated, in the heat-exchanger, from its saturated suction temperature, half way to the saturated condensing temperature.
C_p is taken as the average for the temperature range through which the vapor is heated.
Z is taken at the midpoint of the vapor temperature range.

Tables 1 and 2 show the preparation of the factors *X* and *Y* for representation in curve form. In Fig. 1, values of *T* in Table 2, were plotted against corresponding values of *Y*, for the various pipe sizes; *Y*

values acting as ordinates. Then, on the same chart, using Y again as ordinates, U was plotted against Y; corresponding values being taken from the last two lines of figures in Table 1. From Fig. 1, then, U, for Freon-12 may be read for any tonnage, for any pipe size, and for any refrigerant conditions within the range of our study.

To terminate this discussion here, would seem to be only half solving the problem in hand. After finding the heat transfer coefficient, the engineer is still confronted with the tedious and unwelcome task of employing it, in order to determine the necessary length of a heat-exchanger to accomplish his purpose.

In the article mentioned earlier, the following formula was developed for the heat-exchanger length in question:

$$L = 229.18 \frac{HWT}{UdD} \qquad (4)$$

Where L = length of heat-exchanger, feet

Table 2—Determination of Values of $Y = T^{.8}/d^{1.8}$

Type L Copper Tube			Values of Y When		
Nominal OD, In.	d ID, In.	$d^{1.8}$	T = 10	T = 100	T = 400
⅞	.785	.647	9.755	61.551	
1⅛	1.025	1.045	6.035	38.082	
1⅜	1.265	1.527	4.133	26.076	
1⅝	1.505	2.087	3.023	19.074	
2⅛	1.985	3.435	1.837	11.589	
2⅝	2.465	5.073	1.244	7.847	23.789
3⅛	2.945	6.988		5.694	17.270
3⅝	3.425	9.170		4.341	13.160
4⅛	3.905	11.612		3.428	10.393
5⅛	4.875	17.312		2.300	6.971
6⅛	5.845	24.000		1.659	5.029

$T^{.8} = 10^{.8} = 6.30957$; $100^{.8} = 39.8107$; $400^{.8} = 120.683$.

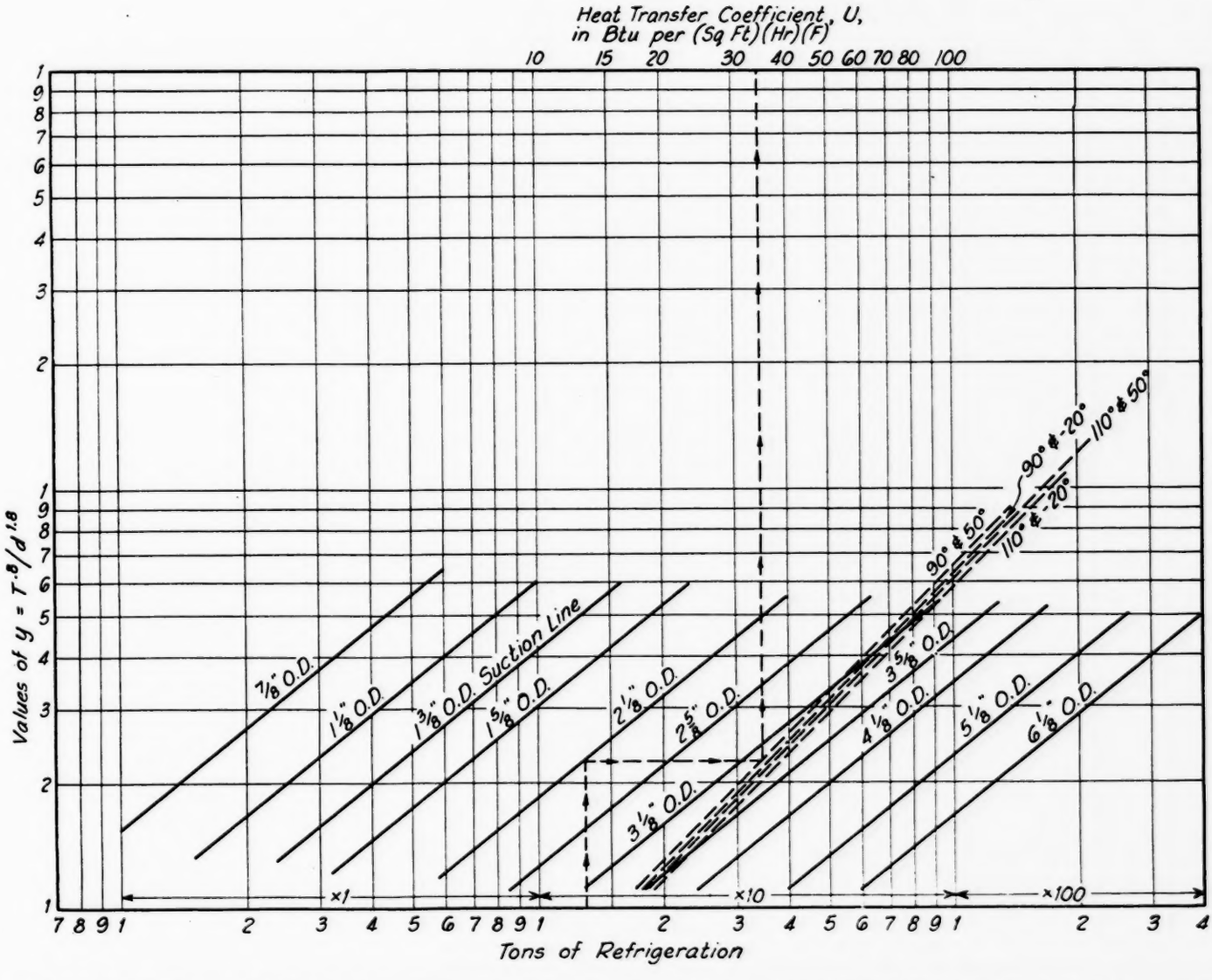


Fig. 1. Heat transfer coefficient in heat exchangers using Freon-12. Example (see dotted line): 13 tons of refrigeration; 2⅛-in. O. D. suction line; 90F condensing temperature; 50F evaporator temperature; follow arrows and read: heat transfer coefficient is 34.6 Btu per (hr) (sq ft) (F).

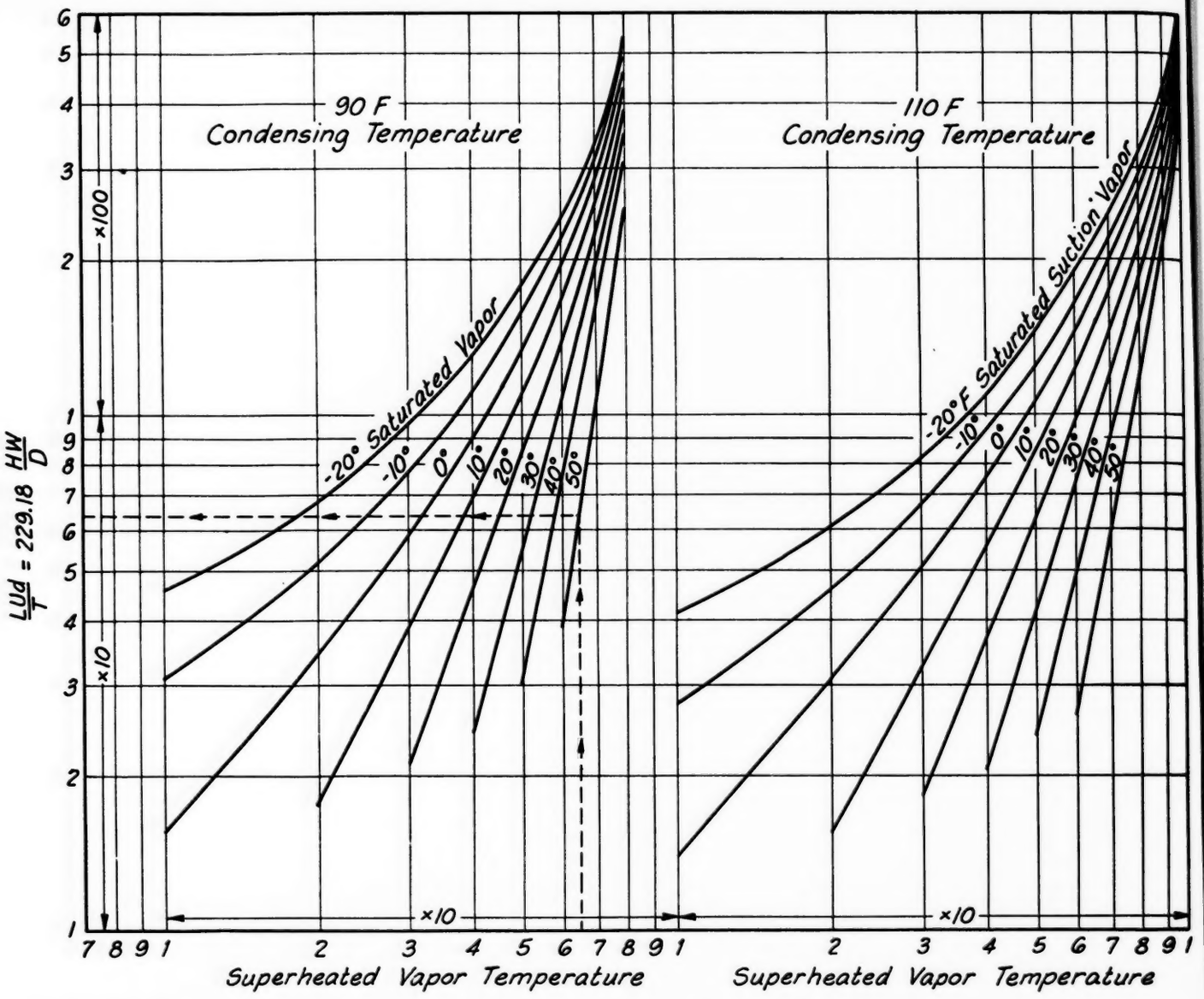


Fig. 2. Chart for determining length of heat exchangers using Freon-12. For example (dotted line) see text.

H = heat transferred per pound of refrigerant, Btu per lb

D = logarithmic mean temperature difference between the liquid and vapor refrigerant, F.

Other symbols as before.

A convenient arrangement of this equation is

$$\frac{LUd}{T} = 229.18 \frac{HW}{D} \qquad (5)$$

If once we can determine the value of $\frac{LUd}{T}$, it will be easy to find L, knowing T from design, U from Fig. 1, and d from Table 2.

The following example demonstrates the calculation of the value of $\frac{LUd}{T}$ for one set of design conditions.

Sufficient similar calculations were made to enable the plotting of the curves in Fig. 2.

Sample Calculation for Plotting Fig. 2

$$\frac{LUd}{T} = 229.18 \frac{HW}{D}$$

Symbols and Data:

t_1 = saturated condensing temperature = 110F

t_3 = saturated suction vapor temperature = 20F

t_4 = superheated suction vapor temperature = 60F

t_2 = sub-cooled liquid temperature = ?

H = heat transferred from liquid to vapor in Btu per lb of refrigerant

W = refrigerant circulated in lb per (min) (ton) of refrigeration

D = log mean temperature difference.

$$D = \frac{(t_2 - t_3) - (t_1 - t_4)}{\log_e \frac{t_2 - t_3}{t_1 - t_4}}$$

Calculations:

Heat content of superheated vapor at 60F = 86.28 Btu per lb

Heat content of saturated vapor at 20F = 80.49 Btu per lb

$H = 86.28 - 80.49 = 5.79$ Btu per lb

Obviously this heat must be removed from the liquid refrigerant

Specific heat of liquid refrigerant at 110F = .250 Btu per (lb) (F)

Therefore, sub-cooling of liquid = 5.79/.250 = 23.16F and

$t_2 = 110 - 23.16 = 86.84$F and

$$\log_e \frac{t_2 - t_3}{t_1 - t_4} = 2.3026 \log_{10} \frac{86.84 - 20}{110 - 60} = 2.3026 \log_{10} 1.3368$$

$= 2.3026 \times .126066 = .290{,}280$ and

$D = (66.84 - 50)/.290.280 = 58.01$F.

$$W = \frac{\text{Btu per min per ton}}{\text{refrigeration effect}} = \frac{200}{80.49 - 33.65} = 4.270$$

$$\frac{LUd}{T} = 229.18 \frac{HW}{D} = 229.18 \frac{5.79 \times 4.27}{58.01} = 97.67$$

The use of Fig. 1 and 2, in the solution of heat-exchanger design problems, is illustrated by the following examples:

Solution of Design Problems

Example 1

Data:

Saturated condensing temperature = 90F
Saturated suction vapor temperature = 50F
Superheated suction vapor temperature = 65F
Tons of refrigeration = 13
Suction line size = 2⅛ in. OD
Find necessary length of heat exchanger.

Solution:

From Fig. 1, U = 34.6

From Fig. 2, $\frac{LUd}{T} = 64$

From Table 2, d = 1.985 in.

Therefore, $L = \frac{LUd}{T} \times \frac{T}{Ud} = 64 \times \frac{13}{34.6 \times 1.985} = 12.11$ ft

Example 2

Data:

Saturated condensing temperature = 110F
Saturated suction temperature = 20F
Superheated suction vapor temperature = 90F
Tons of refrigeration = 100
Suction line size = 4⅛ in. OD
Find necessary length of heat exchanger.

Solution:

From Fig. 1, U = 58.0

From Fig. 2, $\frac{LUd}{T} = 305$

From Table 2, d = 3.905 in.

Therefore, $L = \frac{LUd}{T} \times \frac{T}{Ud} = 305 \times \frac{100}{58 \times 3.905} = 134.7$ ft

Heat-exchangers designed by the use of these two charts, will be found to be somewhat longer than absolutely necessary. This follows from the fact that no credit in the value of *W* was taken when the liquid refrigerant was sub-cooled. Thus, the charts should provide "safe" values for *L* with a margin to spare.

One Method of Heating the Quonset Hut

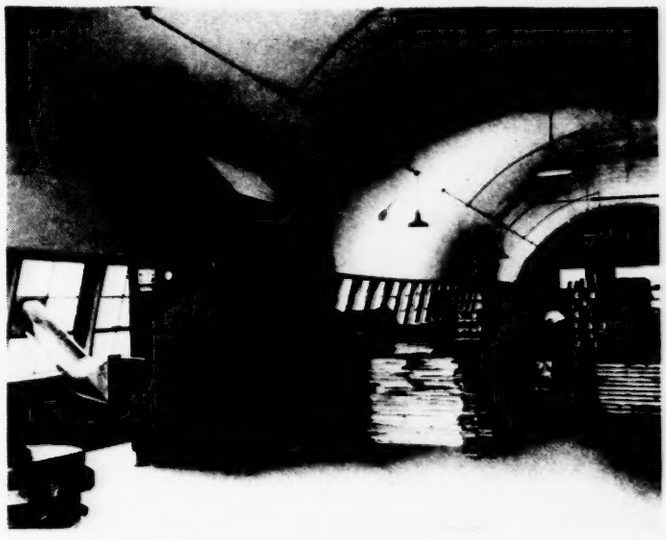
Widespread use of Quonset structures by industrial firms during recent months raises the question of how to heat such buildings adequately and efficiently. When the Army and Navy used these arch-roofed huts for barracks, garages and warehouses, they were considered more in the nature of temporary structures.

However, many Quonsets are being installed today as permanent buildings by industrial firms, as the structures can be erected quickly and economically. Some are being used for warehouses but a large percentage are serving as shipping and manufacturing space. More attention, therefore, is being given to heating systems.

The Stran-Steel Division of Great Lakes Steel Corporation, Terre Haute, Ind., recently supplied one of these Quonset units to a radio manufacturer in Kokomo, Ind. The building is used for a receiving department, some inspection and warehousing. It is 320 ft long and 80 ft wide and 20 ft high.

This building, containing 25,600 sq ft of floor space, is heated by two direct-fired floor heaters. It was not necessary to make any structural alterations or to build additional space for installation of these oil-burning heaters. After the units were positioned in the building, connections had to be made to the power lines, fuel oil piping and vent stack.

Two different sizes of heaters are used in this building. One, with four discharge nozzles and a capacity of 1,250,000 Btu per hr, is capable of handling 17,000 cu ft of air per minute. The other, with a capacity of 750,000 Btu per hr, handles about 8500 cu ft of air per minute and has three discharge nozzles. Both heaters discharge warm air at a velocity of 2,000 fpm over the heads of the occupants.



The larger heater is installed to take care of approximately two-thirds of the building, partitioned off from the other part. The smaller heater services the remaining one-third.

Analysis of low pressure steam

Piping System Construction Costs

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Comparative cost data of piping for school building heating systems using arc welded, flanged and screwed joints and a design using flanged and screwed pipe joints.*

WHENEVER welded pipe joints are being considered in the design and construction of piping systems, we can start with the premise that arc welded pipe joints, when made by qualified welders under standard procedure control for arc welding, are an accepted method of construction. Also, their use assures better pipe joints at lower costs of labor and material per joint than by any other method.

The purpose of this article is:

(1) To assemble all the factual data pertaining to the cost of constructing a piping system designed for low pressure temperature steam service in a modern elementary public school building.

(2) To show and describe the economies in construction costs, that are the direct results of using arc welded pipe joints in combination with standard flanged and screwed pipe joints in its construction, in comparison with the cost of constructing the same piping system using standard cast iron flanged and screwed pipe fittings, which has long been the standard practice on this class of pipe work, due primarily to low first cost.

*Data and illustrations from a study submitted to the James F. Lincoln Arc Welding Foundation by the author in its recent Design for Progress Award Program for reports and advances and improvements made by the applications of arc welding.

Piping Systems

Modern public, commercial and industrial buildings are equipped with several separate and distinct types of pipe systems, each designed for some specific service.

In this article we are concerned with the design and construction of the steam distribution system for supplying low pressure temperature steam from the main steam header, located in the boiler room to the steam supply connections for the radiators and unit heaters that are required to heat and ventilate an elementary public school building.

Design of Piping Systems

We can approach the problems that the design of low pressure temperature piping systems involve, with the definite knowledge that arc welded pipe joints are permanent, leakproof and highly resistant to corrosion. Exhaustive tests have proven that they have ductility nearly equal to that of the pipe and that their strength equals or exceeds that of the parent metal.

This type of construction means fewer joints, less material and reduced dead weight load on pipe hang-

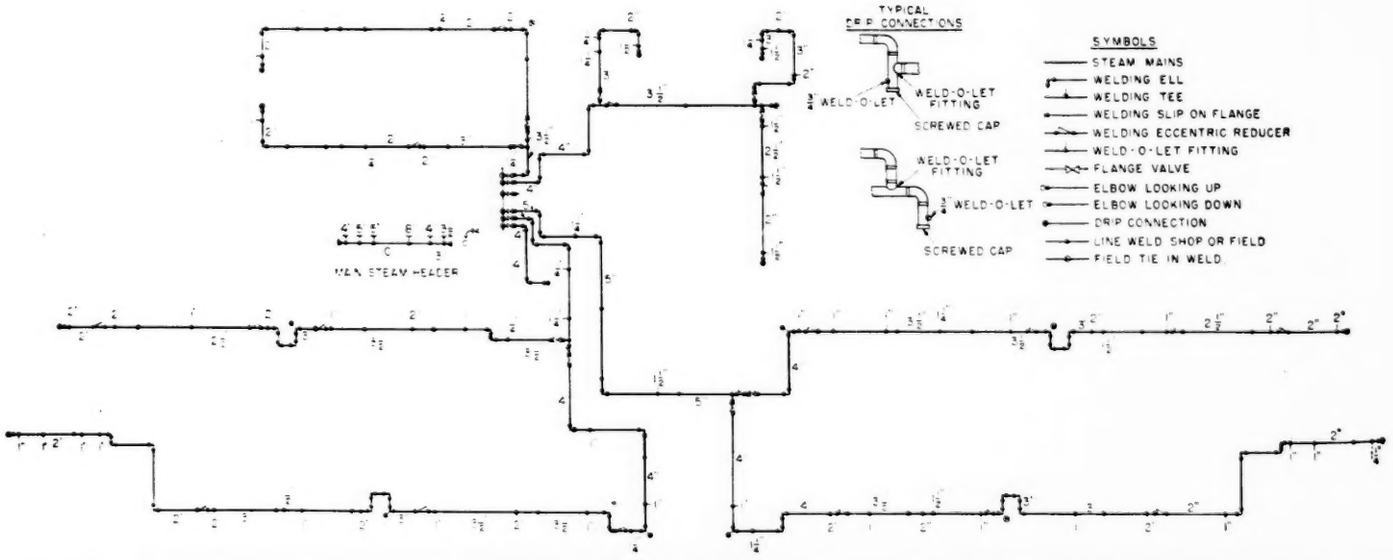

Fig. 1. Flanged, screwed and arc welded pipe joints for steam distribution system to radiators and unit heaters.

ers and supports, and is readily adapted to modern construction methods.

After the installation has been completed and the work tested and proven tight, the pipe can be sealed-in under concrete floors and behind plastered walls or ceilings and forgotten, as the arc welded pipe joints will remain tight throughout the life of the pipe. This means practically little or no expense for maintenance.

However, important as perfect pipe connections are to insure safety and efficiency in the operation of heating, air conditioning and industrial piping systems, the use of welded piping in the building industry has its economic limits, this being particularly true where first cost is usually given consideration in both design and construction. Pipe sizes, kind of service, trouble-free operation and low maintenance cost are some of the determining factors.

While it is true that the actual cost for making an arc welded pipe joint is less than for making a screwed pipe joint on the same size of pipe, this saving in construction costs is more than offset by the wide difference in the cost of standard welding pipe fittings and standard cast iron flanged and screwed pipe fittings.

Therefore, in order to obtain the best possible design within these limits, the piping system must be streamlined, avoiding the use of welding fittings wherever possible and still keep within the bounds of sound engineering. A practical compromise must be reached in the use of flanged, screwed and arc welded pipe joints to permit the use of standard weight flanged and screwed cast iron and brass valves. Standard weight steel valves, beveled for welding are not available, except in the large pipe sizes and their cost is prohibitive on this class of work.

Fig. 1, illustrates the streamlined design, together with the economical and mechanical advantages of using arc welded pipe joints in combination with standard flanged and screwed pipe joints in the construction of low pressure temperature piping systems for supplying steam to the heating and ventilating units in modern school buildings.

Changes in direction of the main piping are made by using 90° welding ells. Weld-O-Let fittings with threaded outlets were used to provide the lateral outlets in the main piping for the supply connections, (they are small size pipe and screwed construction) to the radiators and unit heaters. The cleanout caps for the dirt pockets on all drip connections for the

Table 1 — Number of Pieces to be Handled

Kind of Material	Number of Pieces	
	Fig. 1	Fig. 2
Pipe	49	241
Fabricated header	1	1
Valves	15	15
Flanged fittings	8	8
Screwed fittings	18	18
Gaskets	38	38
Bolts	232	232
Total	361	553

Table 2 — Joints to be Made

Size of Joint, In.	Number of Joints		Size of Joint, In.	Number of Joints	
	Fig. 1	Fig. 2		Fig. 1	Fig. 2
Flanged Joint			Welded Joint (cont.)		
10	2	2	3	98	
8	2	2	2½	26	
5	6	6	2	110	
4	12	12	Screwed Joint		
3½	6	6	5		38
3	8	8	4	3	76
2½	2	2	3½	1	74
Welded Joint			3	7	148
			2½		26
5	26		2	7	120
4	56		Total—		
3½	37		all joints	409	538

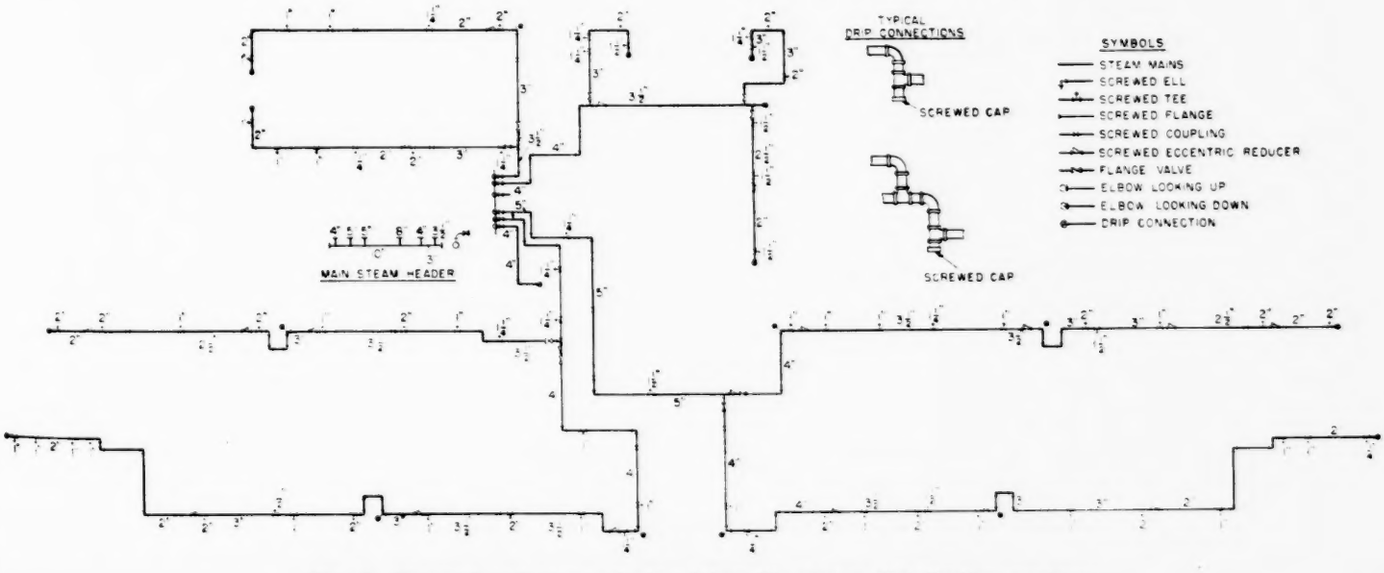

Fig. 2. Flanged and screwed pipe joints for steam distribution system.

Table 3 — Installation of Schedule 40

Fabricated Pipe

Pipe Size, In.	Straight Pieces, Hours Per Piece	Single Bends, Hours Per Bend	Compound Bends, Hours Per Bend
2	0.32	0.40	0.50
2½	0.37	0.46	0.56
3	0.42	0.53	0.63
3½	0.47	0.59	0.71
4	0.54	0.68	0.82
5	0.73	0.92	1.10
6	0.92	1.15	1.38
8	1.40	1.75	2.10
10	1.90	2.38	2.85
12	2.34	2.93	3.51
14	2.60	3.25	3 90
16	2.90	3.63	4.35
18	3.30	4.13	5.00

Table is based on the installation of an average piece, or 10 ft length of pipe. Job operations include erecting and aligning pipe in hangers ready for making on fittings, bolting up flanges or welding joints. Fabrication of pipe and the erecting of pipe hangers, supports, anchors, making on fittings, bolting up flanges, welding joints, testing and repairing leaks are separate and distinct job operations which must be allowed for when using table. Time periods include an allowance for fatigue and lost time.

When the overall lengths of straight pieces and bends exceed 20 ft, multiply time periods by 2.

Table 4 — Installation of Flanged and Welding Fittings, Specials and Valves

Standard and Series 15

Pipe Size, In.	Welding Fittings, Hours Per Unit	Flanged Fittings, Hours Per Unit	Valves, Hours Per Unit
2	0.20	0.20	0.30
2½	0.24	0.24	0.36
3	0.28	0.28	0.41
3½	0.31	0.33	0.50
4	0.36	0.40	0.58
5	0.43	0.47	0.71
6	0.52	0.60	0.94
8	0.78	0.84	1.53
10	1.15	1.26	2 50
12	1.45	1.80	3.90
14	1.70	2.40	5.75
16	2.00	3.12	8.40
18	2.33	3.96	11.00

Table is based on the average time required to install the various types of fittings, specials and valves that are in general use. Time periods for flanged fittings apply on all fittings from flanges to crosses; specials include exhaust heads, separators, expansion joints, anchor fittings, etc. Time periods for welding fittings apply on all types of fittings. Time periods for valves apply on all types of flanged and welded valves. Job operations include erecting and aligning in position ready for bolting up or welding joints. The erecting of hangers, supports, anchors, bolting up or welding joints, are separate and distinct job operations which must be allowed for when using this table. Time periods include an allowance for fatigue and lost time.

main steam piping are screwed fittings. All control valves for the main piping system have standard flanged ends.

Fig. 2 illustrates the numerous pieces of material that must be handled in the shop and field when flanged and screwed pipe joints are used exclusively in the construction of the piping system shown on Fig. 1. All these pieces must be handled and the joints made up service tight by hand, one at a time, regardless of whether the pipe is assembled in its permanent position or assembled in sections on the floor before being erected in their permanent positions on the job.

Table 1 shows the number of pieces of material to be handled in the field on each design, exclusive of pipe hangers and supports (they are the same on both designs, therefore, can be omitted from this discussion). It clearly indicates how the use of the arc welder as a construction tool reduces costs by reducing the number of pieces of material to be handled by the field erecting crews.

Table 2 shows the different types, sizes and number of pipe joints to be made up in the shop and field. By the substitution of arc welded pipe joints for screwed pipe joints wherever practical, as shown on Fig. 1, the potential number of leaks is reduced from 538 to 56. After the piping is welded it becomes 14 continuous leakproof sections joined together at the flanged control valves.

The potential savings in labor and material illustrated by these two tables establishes the economical

Table 5 — Cutting and Threading

Schedule 40—Steel and Wrought Iron Pipe

Pipe Size, In.	Cutting Time, Hours	Threading Time, Hours	Pipe Size, In.	Cutting Time, Hours	Threading Time, Hours
½	0.040	0.05	3	0.072	0.15
¾	0.042	0.06	3½	0.077	0.16
1	0.046	0.07	4	0.083	0.17
1¼	0.050	0.08	5	0.093	0.20
1½	0.055	0.10	6	0.120	0.23
2	0.060	0.12	8	0.183	0.28
2½	0.067	0.14			

Table is based on the average time required to make a single cut or thread, using hand tools for pipe 2 in. and under, and power driven portable tools for pipe 2½ to 8 in., inclusive, floor to floor operations. The time periods include an allowance for fatigue and lost time. Cutting time includes time for measuring the length of piece to be cut at the vise bench.

Table 6 — Make Up, Standard Screwed Fittings

Pipe Size, In.	Bench Make Up, Hours	Field Make Up, Hours	Pipe Size, In.	Bench Make Up, Hours	Field Make Up, Hours
½	0.02	0.03	3	0.16	0.20
¾	0.03	0.04	3½	0.20	0.25
1	0 04	0.06	4	0.29	0.36
1¼	0.05	0.07	5	0.42	0.52
1½	0.06	0.08	6	0.51	0.71
2	0.08	0.10	8	0.92	1.17
2½	0.12	0.15			

Time periods given in this table are based on making up one threaded joint steam tight and they include allowances for handling tools, fatigue and lost time.

Table 7 — Bolting Up of Flanged Joints

Standard and Series 15

Flange Size, In.	Number of Bolts	Diameter of Bolts	Hours Per Joint
1¼ x 4½	4	½	0.20
1½ x 5	4	⅝	0.20
2 x 6	4	⅝	0.20
2½ x 7	4	⅝	0.20
3 x 7½	4	⅝	0.20
3½ x 8¼	4	⅝	0.20
4 x 9	8	⅝	0.40
5 x 10	8	¾	0.53
6 x 11	8	¾	0.53
8 x 13	8	¾	0.53
10 x 16	12	⅞	1.10
12 x 19	12	⅞	1.10
14 x 21	12	1	1.30
16 x 23½	16	1	1.60
18 x 25	16	1⅛	2.13
20 x 27½	20	1⅛	2.70

Table is based on the average time required to insert the gasket and makeup the joint service tight, and follow up on bolts after joint has been placed in service. Time periods include an allowance for fatigue and lost time.

Table 8 — Single Cut or Bevel Straight Across Pipe

Schedule 40—Steel and Wrought Iron Pipe

Pipe Size, In.	Cutting Time, Hours	Oxygen, Cu Ft	Acetylene, Cu Ft
1	0.020	0.30	0.12
1¼	0.020	0.34	0.14
1½	0.022	0.40	0.16
2	0.025	0.50	0.18
2½	0.029	0.63	0.21
3	0.031	0.90	0.29
3½	0.035	1.00	0.34
4	0.037	1.13	0.38
5	0.042	1.25	0.44
6	0.047	1.50	0.64
8	0.053	2.90	0.75
10	0.060	4.30	0.90
12	0.070	5.50	1.10
14	0.081	5.90	1.25
16	0.088	6.75	1.38
18	0.100	7.90	1.56

Time periods and material quantities given in this table include an allowance for starting, stopping, fatigue and lost time, but they do not include any time for laying out work, as this is a separate and distinct job operation and must be allowed for when using table.

Table 9 — Single Cut or Bevel 90° — Branch Connection

Schedule 40—Steel and Wrought Iron Pipe

Pipe Size, In.	Cutting Time, Hours	Oxygen, Cu Ft	Acetylene, Cu Ft
1	0.023	0.38	0.15
1¼	0.025	0.40	0.16
1½	0.027	0.50	0.20
2	0.031	0.63	0.23
2½	0.035	0.80	0.26
3	0.040	1.10	0.36
3½	0.043	1.25	0.43
4	0.048	1.41	0.48
5	0.051	1.56	0.55
6	0.058	1.90	0.80
8	0.067	3.60	0.94
10	0.080	5.50	1.10
12	0.091	6.90	1.36
14	0.101	7.40	1.56
16	0.110	9.00	1.73
18	0.125	10.00	2.00

Time periods and material quantities given in this table are based on the data given in Table 8. They no not include any time for laying out work, as this is a separate and distinct job operation and must be allowed for when using this table.

Table 10 — Arc Welded Rolled Line Joint

Schedule 40 Pipe

Pipe Size, In.	Welding Time, Hours	Kilowatt Hours	Electrodes, Pounds
1	0.13	0.85	0.40
1¼	0.13	0.85	0.40
1½	0.14	0.90	0.43
2	0.16	1.10	0.47
2½	0.19	1.24	0.53
3	0.23	1.50	0.58
3½	0.27	1.70	0.71
4	0.29	2.10	0.88
5	0.36	2.52	0.98
6	0.43	3.00	1.28
8	0.53	4.24	1.78
10	0.62	5.00	2.20
12	0.80	6.40	2.70
14	0.93	7.44	3.10
16	1.10	8.72	3.80

Time periods and material quantities given in this table are based on information obtained from the Lincoln Electric Co. and they include time allowances for tack welding, starting, stopping, cleaning slag from weld, changing electrodes, fatigue and lost time.

and mechanical merits of arc welded pipe joints when they are used in combination with standard flanged and screwed pipe joints in the design and construction of low pressure piping systems in the building industry.

Comparative Costs

Before accurate comparative costs of the two designs of low pressure piping systems being evaluated can be determined, the rules that will govern the procedure must first be established. These are governing rules:

Item 1—Pipe Joints—In the making of any type of pipe joint there are two separate and distinct schedules of job operations to be considered.

(1) Preparation of joint

(2) Completion of joint

Table 11 – Arc Welded Vertical or Horizontal Position Joint

Schedule 40 Pipe

Pipe Size, In.	Welding Time, Hours	Kilowatt Hours	Electrodes, Pounds
1	0.15	0.96	0.48
1¼	0.15	0.96	0.48
1½	0.16	1.00	0.53
2	0.18	1.17	0.57
2½	0 22	1.43	0.64
3	0.27	1.76	0.70
3½	0.30	2.10	0.75
4	0.33	2.31	0.86
5	0.42	2.94	1.21
6	0.50	3.50	1.44
8	0.61	4.90	2.00
10	0.73	5.84	2.48
12	0.92	7.40	3.00
14	1.10	9.00	3.72
16	1.28	10.24	4.30

Time periods and material quantities given in this table are based on the data in Table 10 and they include time allowances for tack welding, starting, stopping, cleaning slag from weld, changing electrodes, fatigue and lost time.

Table 12 – Arc Welded 90° – Branch Joint

Schedule 40 Pipe

Pipe Size, In.	Welding Time, Hours	Kilowatt Hours	Electrodes, Pounds
1	0.37	1.73	0.62
1¼	0.37	1.73	0.62
1½	0.39	1.80	0.67
2	0.41	2.15	0.74
2½	0.50	2.34	0.82
3	0.53	2.60	0.90
3½	0.60	3.20	1.10
4	0.64	3.50	1.32
5	0.72	4.00	1.52
6	0.85	4.76	2.00
8	1.00	6.64	2.76
10	1.31	8.32	3.41
12	1.53	10.56	4.20
14	1.75	12.32	4.92
16	2.00	14.40	5.60

Time periods and material quantities given in this table are based on the data in Table 10 and they include time allowances for tack welding, starting, stopping, cleaning slag from weld, changing electrodes, fatigue and lost time.

The job operations required to make arc welded and screwed pipe joints are given in the following schedules and they will be used in figuring the time required to complete the various types of pipe joints being considered.

Preparation of Joints

Arc Welded Joint	*Screwed Joint*
Measure pipe at bench	Measure pipe at bench
Cutting pipe	Cutting pipe

Table 13–Estimate of Shop Labor–Time and Cost

Fig. 1 Design

Units	Size, In.	Hours	Units	Size, In.	Hours
		Line cuts and bevels			
32	5	1.35	129	3	4.00
73	4	2.70	26	2½	.76
63	3½	2.31	76	2	1.90
		90° Branch Cuts			
5	4	0.24	9	1½	0.25
8	3	0.32	13	1¼	0.33
1	2½	0.04	28	1	0.65
16	2	0.50	18	¾	0.42
		Line welds (Rolled)			
17	5	6.12	75	3	17.25
42	4	12.18	14	2½	2.66
31	3½	8.37	45	2	6.88
		90° branch welds			
5	5	3.60	16	3	8.50
8	4	5.04	9	2½	4.50
1	3½	0.60	59	2	28.19
		Threads			
3	4	0.51	7	3	1.05
1	3½	0.16	7	2	.84
				Extra shop labor	24.00
				Total hours	146.22
146.22	welder hours @ $2.00 per hr				$ 292.44
146.22	helper hours @ $1 25 per hr				182.78
					$ 475.22

Preparation of Joints—(Cont.)

Arc Welded Joint	*Screwed Joint*
Beveling pipe	Reaming pipe
Set up work	Threading pipe
Tack Welding	Straighten pipe

Completion of Joint

Arc Welded Joint	*Screwed Joint*
Weld Joint	Make on fitting
Straighten pipe	

Item 2—Material and its cost—Before the actual cost of the material required to construct a piping system can be determined, a quantity survey of the various kinds of material that enter into its construction must be made. To facilitate the pricing of the material, each item is listed in an orderly manner on the estimate sheets in their natural sequence. With a working knowledge of the current market prices, the cost of the various items are readily obtained. This procedure will be used in making up the material estimates.

Item 3—Labor—Estimating the labor required to fabricate and construct piping systems is a complex operation, due primarily to the large number of variables involved. In order to simplify the process and to keep estimating costs down to a minimum in his

Table 14—Estimate of Field Labor—Time and Cost

Fig. 1 Design

Units	Size, In.	Hours	Units	Size, In.	Hours
		Header erected in place			
1	10	4.00			
		Pipe erected in place			
7	5	10.50	13	3	10.92
10	4	10.40	3	2½	2.22
8	3½	7.52	8	2	4.96
		Valve erected in place			
1	8	1.55	2	3½	1.00
2	5	1.42	4	3	1.64
5	4	2.75	1	2½	.36
		Standard flanged fittings, erected in place			
2	10	2.60	2	4	.67
1	8	.82	1	3½	.27
2	5	.82			
		Standard flanged joints			
2	10	2.02	6	3½	1.20
2	8	1.06	8	3	1.60
6	5	3.18	2	2½	.40
12	4	4.80			
		Field fitting make ups			
3	4	1.07	7	3	1.40
1	3½	.25	7	2	.65
		Field tie in line welds			
4	5	1.65	7	3	1.89
6	4	1.98	3	2½	.66
5	3½	1.50	8	2	1.44
		Handling material			24.00
		Testing and repairing leaks			16 00
		Cleaning up job			8.00
					139 17
130.05	steamfitter hours @ $2.00 per hr				$ 260.10
130.05	helper hours @ $1.25 per hr				162.56
					$ 422.66
9.12	welder hours @ $2.00 per hr				18.24
9.12	helper hours @ $1.25 per hr				11.40
					$ 29.64

Cost of piping material fittings called for in Fig. 1.	$1,820.33
160 cu ft acetylene	2.25
450 cu ft oxygen	12.60
275 lb electrodes	30.25
700 kw electric current	35.00
	$1,900.43
Cost of piping and fittings called for in Fig. 2	$1,664.89
8 gal cutting oil	11.20
20 lb pipe joint cement	7.00
400 kw electric current	20.20
	$1,703.09

Table 15—Estimate of Shop Labor—Time and Cost

Fig. 2 Design

Units	Size, In.	Hours	Units	Size, In.	Hours
		Cuts			
19	5	1.76	74	3	5.35
38	4	3.16	13	2½	.87
37	3½	2.85	60	2	3.60
		Threads			
38	5	7.60	148	3	22.20
76	4	12.92	26	2½	3.64
74	3½	11.84	120	2	14.40
		Shop fitting make ups			
19	5	7.98	74	3	11.84
38	4	11.02	13	2½	1.56
37	3½	7.40	60	2	4.80
				Extra shop labor	8.00
					142.79
142.79	steamfitter hours @ $2.00 per hr				$ 285.58
142.79	helper hours @ $1.25 per hr				178.49
					$ 464.07

Table 16—Estimate of Field Labor—Time and Cost

Fig. 2 Design

Units	Size, In.	Hours	Units	Size, In.	Hours
		Header erected in place			
1	10	4.00			
		Pipe erected in place			
19	5	13.87	74	3	52.08
38	4	20.52	13	2½	4.81
37	3½	17.39	60	2	19.20
		Valve erected in place			
1	8	1.55	2	3½	1.00
2	5	1.42	4	3	1.64
5	4	2.75	1	2½	.36
		Standard flanged fittings, erected in place			
2	10	2.60	2	4	.67
1	8	.82	1	3½	.27
2	5	.82			
		Standard flanged joints			
2	10	2.02	12	4	4.80
2	8	1.06	6	3½	1.20
6	5	3.18	8	3	1.60
			2	2½	.40
		Field fitting make ups			
19	5	9.88	14	3	14.80
38	4	13.68	13		1.95
37	3½	9.25	60		6.00
		Handling material			24.00
		Testing and repairing leaks			16.00
		Cleaning up job			8.00
		Total hours			263.59
263.58	steamfitter hours @ $2.00 per hr				$ 527.18
263.59	helper hours @ $1.25 per hr				329.49
					$ 856.67

own office, the author has compiled a set of estimating tables for this purpose. Tables 3 to 12, inclusive, will be used in figuring the labor required to construct the piping systems being considered.

Detailed Estimates of Piping Systems

The material, together with costs that enter into the construction of each design of piping system being considered, and the amount of labor required to fabricate and erect the material in position on the job (exclusive of pipe hangers and supports) are given on page 83.

In order to place both types of construction on an equal basis, plain end, schedule 40 black steel pipe will be used in figuring the time required to prepare and complete the pipe joints for each design.

Analysis of the comparative estimated costs of the two piping systems being considered show an actual saving of $282.87 or 7.4% in favor of the arc welded, flanged and screwed pipe joint construction over the flanged and screwed pipe joint construction.

This saving represents a reduction of $393.22 or 30% in labor costs which was effected by careful planning for the fabricating of all welded piping in the shop, in sections of such size to permit their being erected in position on the job. The final field connection was made with the maximum economy of field erecting labor and field welding.

To this saving in construction costs of piping systems, as a direct result of substituting arc welded pipe joints for standard cast iron screwed pipe fittings, may be added less pipe covering installation costs.

Pipe covering cost for Fig. 1 is $1,258 and for Fig. 2, $1,366. The saving amounts to $108 or 8% of the covering cost.

The data show that low pressure piping systems, using a combination of arc welded, standard flanged and screwed pipe joints to permit the use of standard flanged and screwed cast iron and brass valves in their construction, can successfully compete with the low cost standard cast iron flanged and screwed pipe fittings on this low first cost, highly competitive class of pipe work.

Table 17 — Comparative Cost Analysis

Material and Labor	Fig. 1	Fig. 2
Pipe	$ 632.72	$ 632.72
Fabricated header	197.00	197.00
Flanged fittings	60.41	96.48
Welding fittings	381.63	
Screwed fittings	9.45	299.57
Valves	408.70	408.70
Bolts and gaskets	30.42	30.42
Electrodes	30.25	
Acetylene	2.25	
Oxygen	12.60	
Pipe joint cement		7.00
Cutting oil		11.20
Electric current	35.00	20.00
Shop labor	475.22	464.07
Field erecting labor	209.36	473.70
Field welding	29.64	
Field screwed joints	10.95	180.62
Field flange joints	46.35	46.35
Testing and repairing leaks	52.00	52.00
Handling material	78.00	78.00
Clean up job	26.00	26.00
Cartage	50.00	50.00
Liability insurance and S. S. tax	92.75	132.08
Overhead and profit	594.14	132.08
Total	$ 3,564.84	$ 3,847.71

Conclusion

The economies resulting from the use of arc welded pipe joints in the design and construction of low pressure piping systems in elementary school buildings, such as the subject of this article, are due primarily to the reduction of labor costs. The methods by which they can be achieved are described and substantiated by the text.

Advantages resulting from the progress made in the use of arc welded piping in the building industry are exemplified by better design, lower construction costs, trouble free service at little or no expense for maintenance, due to the strength, ductility and high resistance to corrosion of leakproof arc welded pipe joints.

Fire Control Aided by Escalator Exhaust

Controlled air is the basic element of a new method of fire protection for open escalators installed in the J. C. Penney Co. store in Cincinnati. In principle, the new method combines the use of negative air pressures to isolated the fire, a suction air to remove smoke and exhaust it outside the building, and a deluge water curtain around each escalator opening to prevent flames from spreading to other floors. The air cycle part of the new system was furnished by Carrier Corp. The J. C. Penney store, occupying seven stories, has open escalators from the main floor to the fifth floor. If a fire occurs and the temperature rise exceeds the rate of rise setting of thermostats distributed on each floor, these thermostats open an outside air damper in an exhaust system which surrounds each floor opening. The branch damper for the floor on which the fire exists is also opened and the exhaust fan on the upper floor started. This exhaust creates a negative pressure on this floor to exhaust the smoke and prevent its flow to any other floor. An automatic intake on the fifth floor tends to create a downdraft in the escalator well.

Through an alarm bell and annunciator system in the engineer's office, the fire condition and its location are transmitted to his attention in order that action may be taken. If the fire spreads to the escalators proper, the sprinkler pilot heads release to set off a water curtain surrounding the escalator.

NUMBER OF SUNSHINE HOURS IN HEATING SEASON

AVERAGE NUMBER OF SUNSHINE HOURS IN A NORMAL HEATING SEASON—*(Concluded)*

State and City	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
New Hampshire													
Concord	124	168	205	228	254	314	—	43	225	186	135	127	2009
Hanover	115	168	202	222	251	233	—	81	213	167	120	112	1884
Keene	124	168	202	225	257	235	—	68	219	171	120	124	1913
New Jersey													
Atlantic City	158	171	205	231	279	73	—	—	56	217	180	155	1725
Belvidere	140	168	195	225	255	—	—	—	120	186	150	140	1579
Bridgeton	155	168	202	231	160	—	—	—	40	217	177	152	1502
Newark	146	171	202	231	221	—	—	—	80	202	156	146	1555
Somerville	143	171	202	228	252	—	—	—	96	202	165	146	1605
Trenton	146	171	202	231	209	—	—	—	56	208	168	149	1540
New Mexico													
Albuquerque	233	230	285	306	341	222	—	—	68	285	243	236	2449
Raton	223	216	257	270	310	215	—	20	282	270	225	229	2517
Santa Fe	226	227	279	300	332	173	—	—	288	279	240	236	2580
New York													
Albany	115	157	192	210	248	28	—	—	140	161	114	105	1470
Auburn	90	132	177	195	263	124	—	—	194	158	90	71	1494
Binghamton	93	134	177	192	254	108	—	—	189	152	87	74	1460
Buffalo	84	112	171	210	270	160	—	—	175	164	90	71	1507
Cortland	93	134	177	192	254	228	—	90	210	152	87	74	1691
Elmira	93	132	177	192	248	54	—	—	168	155	90	78	1387
Glens Falls	109	154	186	204	257	84	—	—	207	155	105	90	1551
Ithaca	90	129	174	192	263	86	—	—	187	158	90	71	1440
Jamestown	87	112	167	201	270	167	—	—	203	167	90	71	1535
Little Falls	102	151	183	204	248	202	—	30	204	152	90	78	1644
New York	146	171	202	231	255	—	—	—	56	202	156	146	1565
Oswego	90	129	177	210	263	154	—	—	199	155	84	74	1535
Port Jervis	130	168	192	210	248	46	—	—	158	177	132	124	1585
Syracuse	93	134	177	195	263	38	—	—	175	152	84	74	1385
North Carolina													
Asheville	146	160	186	228	230	—	—	—	211	233	198	140	1732
Charlotte	161	171	208	246	—	—	—	—	—	168	210	149	1313
Greensboro	155	168	202	246	48	—	—	—	—	209	195	146	1369
Hatteras	174	174	220	255	19	—	—	—	—	84	195	174	1295
Raleigh	164	174	211	252	19	—	—	—	—	166	201	158	1345
Salisbury	158	171	205	205	19	—	—	—	—	168	204	149	1369
Wilmington	174	176	226	218	—	—	—	—	—	196	210	174	1374
North Dakota													
Bismarck	146	171	211	249	264	182	—	47	231	189	147	130	1967
Grand Forks	140	165	208	246	254	216	—	139	219	174	135	109	2005
Jamestown	146	171	211	249	264	228	—	99	228	186	147	130	2059
Minot	140	165	211	246	254	233	—	137	222	183	141	121	2053
Williston	130	160	214	246	248	230	—	83	225	183	138	121	1978
Ohio													
Akron	87	112	155	198	273	29	—	—	139	186	105	78	1362
Cincinnati	112	143	171	216	191	—	—	—	49	217	150	109	1358
Cleveland	90	112	164	198	279	58	—	—	133	183	105	78	1400
Columbus	109	126	158	210	218	—	—	—	64	205	132	96	1318
Dayton	112	140	171	216	198	—	—	—	65	214	147	109	1372
Lima	109	137	171	213	282	—	—	—	136	202	153	112	1515
Marion	109	126	161	210	246	—	—	—	88	202	129	93	1364
Sandusky	93	126	171	204	282	—	—	—	94	186	120	87	1363
Toledo	99	132	171	207	279	—	—	—	117	214	120	87	1426
Warren	87	112	155	198	273	106	—	—	152	177	99	74	1433
Oklahoma													
Muskogee	161	168	214	222	54	—	—	—	—	175	189	152	1335
Oklahoma City	174	179	220	231	44	—	—	—	—	172	189	171	1380
Tulsa	167	174	220	225	54	—	—	—	—	185	189	161	1375
Oregon													
Baker	102	143	208	255	291	318	130	167	294	223	138	112	2381
Eugene	102	126	161	210	229	270	96	115	216	202	99	99	1925
Pendleton	90	126	208	246	290	—	—	—	140	214	123	93	1530
Portland	78	98	121	207	229	270	—	—	210	149	72	62	1496
Salem	90	112	155	207	233	270	56	9	216	155	78	74	1655
Pennsylvania													
Altoona	93	126	164	192	246	60	—	—	154	164	120	193	1512
Bethlehem	133	165	195	225	187	—	—	—	87	202	150	140	1484
Erie	84	109	167	201	273	88	—	—	141	171	90	71	1395
Harrisburg	124	148	186	210	227	—	—	—	85	186	150	124	1440
Lancaster	140	165	208	225	232	—	—	—	136	202	165	140	1613
New Castle	87	106	155	195	252	—	—	—	135	186	105	78	1299
Philadelphia	146	168	202	231	194	—	—	—	24	214	171	146	1496
Pittsburgh	87	106	149	192	184	—	—	—	68	192	111	81	1170
Reading	140	162	192	225	213	—	—	—	104	202	165	140	1543
Scranton	118	151	186	201	246	27	—	—	137	171	120	109	1466
Uniontown	90	112	155	192	190	—	—	—	138	155	114	84	1230
Warren	87	109	161	195	267	171	—	—	210	171	105	74	1651
Williamsport	105	137	177	195	237	—	—	—	137	171	132	87	1378
York	140	160	192	225	224	—	—	—	112	202	165	140	1560
Rhode Island													
Block Island	146	171	208	231	263	247	—	—	160	202	156	155	1939
Providence	140	171	205	228	263	124	—	—	177	198	150	143	1799

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NUMBER OF SUNSHINE HOURS IN HEATING SEASON

State and City	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
South Carolina													
Charleston	174	176	233	148	—	—	—	—	—	42	204	164	1141
Columbia	164	174	217	176	—	—	—	—	—	117	210	149	1207
Greenville	155	165	202	231	76	—	—	—	—	203	210	146	1388
Spartanburg	155	168	202	240	19	—	—	—	—	200	204	146	1334
South Dakota													
Huron	158	179	211	252	270	100	—	—	200	205	168	146	1889
Pierre	164	179	217	249	270	173	—	—	213	202	171	146	1984
Rapid City	171	182	236	255	270	168	—	—	226	202	171	155	2036
Sioux Falls	161	179	211	240	273	60	—	—	198	214	165	146	1847
Yankton	167	179	217	240	273	—	—	—	128	217	171	149	1741
Tennessee													
Chattanooga	136	151	189	222	—	—	—	—	—	169	195	124	1186
Knoxville	130	146	180	219	62	—	—	—	—	205	192	121	1255
Memphis	146	160	205	200	—	—	—	—	—	140	189	140	1180
Nashville	136	151	195	152	38	—	—	—	—	182	186	124	1164
Texas													
Abilene	180	174	217	140	—	—	—	—	—	107	192	167	1177
Amarillo	195	199	233	258	169	—	—	—	9	260	210	195	1728
Brownsville	192	199	—	—	—	—	—	—	—	—	35	186	612
Corpus Christi	189	188	113	—	—	—	—	—	—	—	285	177	952
Dallas	167	165	211	118	—	—	—	—	—	107	189	152	1109
El Paso	236	230	298	231	—	—	—	—	—	171	249	211	1626
Ft. Worth	171	165	211	111	—	—	—	—	—	82	189	155	1084
Galveston	177	179	189	—	—	—	—	—	—	—	124	171	840
Houston	177	174	159	—	—	—	—	—	—	—	174	155	839
Palestine	167	165	211	75	—	—	—	—	—	70	186	149	1023
San Antonio	180	168	175	—	—	—	—	—	—	—	179	155	857
Utah													
Logan	136	151	214	255	304	226	—	—	242	239	177	136	2080
Modena	189	202	242	279	308	242	—	—	267	276	216	183	2404
Ogden	136	151	214	255	274	—	—	—	160	242	180	136	1748
Salt Lake City	140	151	214	258	277	91	—	—	143	242	186	158	1860
Vermont													
Burlington	93	151	183	207	239	114	—	—	201	152	90	78	1508
Northfield	99	154	186	210	239	282	—	189	210	155	105	93	1922
Virginia													
Charlottesville	146	168	198	240	114	—	—	—	105	217	168	140	1496
Danville	155	168	202	246	57	—	—	—	—	163	189	146	1326
Lynchburg	149	168	192	240	66	—	—	—	16	145	174	143	1293
Norfolk	167	174	211	240	101	—	—	—	—	147	189	161	1390
Richmond	161	171	205	240	95	—	—	—	—	199	183	149	1403
Roanoke	143	160	186	240	130	—	—	—	23	217	174	140	1413
Washington													
Aberdeen	68	115	161	201	226	237	248	246	186	140	75	71	1974
Bellingham	59	101	177	204	236	255	295	264	177	121	57	59	2005
Olympia	59	98	171	204	233	255	279	264	177	124	60	62	1986
Seattle	56	98	177	207	233	249	295	270	177	121	57	59	1999
Spokane	62	106	192	240	254	230	—	11	243	171	75	59	1643
Walla Walla	76	115	205	246	304	93	—	—	158	205	105	90	1597
Yakima	62	98	186	225	270	107	—	—	224	171	75	59	1477
West Virginia													
Charleston	93	126	155	195	95	—	—	—	—	155	120	90	1029
Elkins	93	126	161	195	246	42	—	—	140	155	117	109	1384
Fairmont	90	112	155	192	182	—	—	—	69	155	114	105	1174
Parkersburg	90	112	149	192	152	—	—	—	45	177	117	102	1136
Wheeling	87	112	155	195	174	—	—	—	83	186	114	81	1187
Wisconsin													
Beloit	127	154	192	234	279	38	—	—	154	192	144	118	1632
Eau Claire	136	162	195	234	267	91	—	—	204	180	129	118	1716
Green Bay	124	148	186	222	264	140	—	—	210	171	108	105	1678
La Crosse	136	165	198	237	270	20	—	—	165	183	120	121	1615
Madison	127	157	195	231	270	73	—	—	167	186	135	118	1665
Milwaukee	118	148	186	225	270	131	—	—	167	183	120	115	1663
Oshkosh	124	154	189	222	270	112	—	—	188	180	120	115	1674
Sheboygan	121	146	186	222	267	214	—	—	195	180	117	112	1760
Wyoming													
Casper	183	193	242	264	276	214	—	28	258	223	177	174	2232
Cheyenne	195	196	242	267	276	324	21	87	264	239	195	183	2489
Yellowstone Park	124	168	226	261	264	300	353	326	246	208	147	124	2747

The foregoing data (Reference Data 369-370 and 371-372) are from Weather Bureau maps giving the average number of sunny hours per day for each of the twelve months. These averages were multiplied by the number of days per month for those months fully in the normal heating season; for the months in which the heating season begins or ends, the number of days used was the number of days in that month which fall within the normal heating season. In other words, the summer months are excluded entirely, so that Northern cities show a relatively larger number of sunny hours than Southern locations due to the greater length of heating season.

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ROBERT A. LAWDER
Minneapolis-Honeywell Regulator Co.

Controls that will permit temperatures of apartments to be regulated within set limits to suit the occupants, result in the elimination of annoying heating problems and in reducing fuel costs. Article discusses various phases of problem and presents examples to show how controls function.

DURING the last few years, heating engineers have come to realize that in providing heating facilities for apartment houses they encounter one of the most difficult and personalized problems that ever disturbs their peace of mind. While they actually are under contract only to one person, indirectly they are committed to assure comfort to every tenant under the roof.

Primarily, of course, they are concerned with supplying the builder and operator a system which is the most efficient and economical that his money can buy, taking into consideration not only initial outlay but also fuel and maintenance costs. However, they also are obligated indirectly to give the ultimate consumers, the residents, the optimum of comfort and healthful living conditions.

The ideal solution, of course, is to find a single method of satisfying all interests.

Some concept of how heating engineers feel about controls is given in an article Trends in Apartment House Heating* which presents the results of a survey made to determine which phase of apartment house heating is most in need of improvement. Of the 32 engineers quoted in this article, 28 expressed an opinion regarding the need for improved temperature controls. Of this 28, the need for individual room controls was voiced by 11 engineers. The article stated:

"There is also a feeling that less of the total cost of apartment house construction should be spent for ornate public space and more money should be directed to the heating system and its controls."

Apparently, subconsciously, the heating engineers were reflecting the feelings that apartment house tenants have been expressing in varying degrees of vocal strength for many years. It's a rare apartment dweller, indeed, who at some time has not been either too hot or too cold.

In many cases radiators have been installed in bank formations with the same amount of radiation being installed on all floors. Generally the top floors have been under-radiated, while some of the intermediate floors have been over-radiated. The rooms in the vicinity of the boiler rooms have received too much heat while those at the end of long runs have remained cold. As it has become colder outdoors, it has been necessary to push the boilers in order to get enough heat to the most distant radiators. Occupants in hard-to-heat rooms have shivered in a cold 68 to 70F, while those nearest the boilers have sweltered in a torrid 80F or higher.

Experience shows that nine out of ten times when a room becomes overheated, some human reflex dictates that the occupant raise the windows instead of close the heat supply to the radiators. So the boiler roars away, trying to heat the great outdoors.

While in the past these conditions have been the rule rather than the exception, there is a definite trend toward more efficient heating systems and controls. The first step was taken by those who wanted some regulation that would eliminate the hit-and-miss uncertainty of manual controls. These pioneers zoned their buildings to supply to each zone the amount of heat required according to outdoor demands. Heat was supplied through a motorized valve controlled by an outdoor temperature control.

Other apartment houses have used outdoor controllers to operate the boilers. As the outdoor temperature drops, the burner operates oftener, while upon a rise in temperature, the burner operates less often.

The marked fuel economies and greater comfort realized from zone control led to a deeper study of further refinements of heat regulation. It resulted in the development of a system of individual controls which give each apartment heating comfort that is equal or superior to that available in private homes. General opinion among apartment building operators has been found to be that about 10% of apartment house tenants want 76F or more, 80% want 72F and 10% desire 70F or less.

Heating engineers know that without individual apartment controls it is necessary to maintain the entire building or zone at a minimum of 76F to satisfy enough of the tenants. If any of the tenants desiring 76F or more are located on the windy side of the building, the temperature in the apartments on the protected side of the building may reach or exceed 80F. And yet, the average temperature required in the whole building for tenant satisfaction is only 72.2F.

Tests run on a large number of buildings in all parts of the country show that an average fuel saving of 20% may be expected when adequate temperature controls are used and that larger economies often result from their use.

*Wolpert, Nathan N., Trends in Apartment House Heating, HEATING AND VENTILATING, Vol. 43, No. 5 (May, 1946) pp 78-79.

These economic advantages can be illustrated readily by taking a New York City apartment house as an example and figuring the possible savings on a degree day basis. There is an average of 215 days in New York City when the mean temperature drops below 65F. Thus if the average mean temperature is 64F each day, there would be 215 degree days. But with a total of approximately 5,300 degree days in a normal heating season, 215 represents 4.06% of the total. This means that each degree of average mean temperature up or down either increases or lessens the heat requirements by 4.06%. For every degree over 70F that is maintained in a building, there is an increase in normal operating expense of 4.06%. The reverse is also true. If a New York apartment house operates at 72F instead of 76F, the former operating expense yields a saving of 4 x 4.06% or 16.24% on fuel. An additional saving of 4.06% can be figured on each average degree lowered.

Factors for Added Dividends

While lowered operating costs are of prime importance to apartment house owners and managers, there are six other main factors that pay additional dividends when proper temperature controls are installed. They are:

(1) Individual Requirements of the Tenants—Heating demands which vary due to differences in age and physical condition of tenants can be satisfied by individual thermostats. The landlord may install a thermostat that permits free operation by the tenant, but which contains a high limit setting. That is, a careless person may turn the dial to its highest setting and yet not waste heat because of the high limit setting which is determined by the building superintendent.

(2) Solar Radiation—This is a factor that is very important in buildings with large outside areas. If the sun is shining on one side or part of a side of a structure, the apartment affected naturally require less heat than those on the other side. Individual apartment thermostats on that part of the building will prevent overheating. Temperature will be held at the desired comfort levels, windows do not have to be opened and fuel is saved.

(3) Wind Velocity—This is a factor directly opposite to solar radiation in its effect. The side or part of the building struck by a cold wind will require more heat than a section not so affected, but the thermostats in apartments in such an area will compensate for the additional heat required in these apartments without boosting the temperature in the whole building or zone and thus wasting heat.

(4) Heat Distribution—In many structures, where long runs of piping are required to reach apartments at some distance from the boiler, trouble is often encountered in the underheating of apartments farthest away, while the apartments nearer the heat supply are greatly overheated. When individual apartment thermostats are installed, this condition is corrected, with just enough heat going to each suite regardless of its location.

(5) Personalized Heating Control System and Its Psychological Value — Before discussing this, it is necessary to describe the most common type installation of personalized heating control system. This is where the radiator valve of each apartment are controlled by one or more thermostats to supply exactly the amount of heat needed to hold the rooms of the apartment at the desired temperature. Usually these thermostats and valves are operated by air pressure as this type of system offers an inexpensive modulating type of control with a minimum of maintenance and a maximum of efficiency. The thermostats and radiator valves are interconnected by small copper tubing which is concealed in the walls and floors of the building. An air compressor in the boiler room supplies air at the proper pressure for the operation of the system through supply mains and branch lines that lead to each of the thermostat-radiator lines in the various parts of the building.

With this modulating type of control there is furnished a psychological advantage to building operators that is not obtainable with a control that either is just "off" or "on." The type of modulating valve used functions between off and on and by such an operation keeps the proper amount of heat in the radiator to maintain the desired temperature. This eliminates the cause for complaint on the part of the tenant who raises a howl because the radiator is cold regardless of the room temperature. Many tenants are happier at lower temperatures, if their radiators feel warm.

(6) The Health Angle—Another great advantage, both psychological and physical, is the health angle. Today there is full recognition of the value of uniform temperature, especially for children. In most existing apartment buildings today it is nearly impossible to supply tenants with draft-free heating.

Indicative of the swing toward individual controls is the fact that in 72 localities throughout the nation, 527 apartment buildings comprising 11,987 apartments, have installed or will include some such form of heating control. Among the prominent examples are the de-luxe projects of the City Investing Company, New York City; and apartment buildings built by Sam Minskoff & Son, David Rose and Samuel Rudin, New York City. Great Oaks, a four-building project of 600 suites for veterans, will have a thermostat in each living room controlling the valves on radiators in living rooms and bedrooms. The new School House Lane apartment building which will be built in Philadelphfia and Hancock Village in Boston, an 860-apartment project sponsored by John Hancock Life Insurance Co., also will have these controls. Chicago's outstanding example is the 20-building project, comprising 1,100 apartments.

Proper Regulation

Although each apartment project presents an individual problem of control, for the sake of discussion the subject of proper regulation can be broken down into three general classifications. They are:

(1) Controlling the radiator valves in each apartment by using one or more thermostats. This has been

described earlier to show the psychological value of true modulating control. This system permits the boiler to run under pressure and obviates the necessity of any form of zone control. Each apartment receives only the heat necessary to reach and maintain the temperature specified on the thermostats. Either night shut-down or lowered night operating temperature may be incorporated in the system.

(2) Controlling each apartment with one valve and one thermostat. This type of control system has been widely accepted and installed in the increasingly popular garden type apartments, many of which are financed and constructed under FHA. With the growing use of the forced-hot-water system, this type control is almost a must. The most common type of installation calls for long runs of mains for the length of the development with a basement loop being taken off the main to feed each apartment and flowing back into a common return that takes the water back to the boiler.

A thermostat located in each living room controls a modulating valve installed in the loop supplying the apartment, so that on a rise in space temperature the valve will close gradually and on a drop in temperature it will open. Hand valves are not needed on the radiators. Instead, an adaptable balancing elbow is installed in each radiator so that maximum temperature control and operation efficiency may be obtained.

The boiler room controls that go with this system are generally: A timer for night shutdown; timer for periodic circulator operations at night to prevent radiator freeze-up; outdoor controller to prevent circulator operation when the outdoor temperature is above 65F; outdoor controller to prevent periodic circulator operation at night when the outdoor temperature is above 35F; aquastat to maintain water temperature of 120 to 140F in storage tank for domestic hot water supply; aquastat to maintain boiler water temperature for winter heating; relay for control from heating aquastat during circulator operation to domestic hot water aquastat during summer. If more than one circulator is used, a relay is used for operation of both circulators.

This system does three things: (1) It supplies a most economical form of heating, (2) it assures heat to the apartments farthest from the boiler, (3) it prevents overheating in the apartments nearest the heat supply.

While this type of control system has been used to the greatest extent in garden-type apartments, it is also receiving much consideration in the so-called luxury type buildings. Risers supplying the forced hot water feed into a loop that encircles each apartment from which all radiators or baseboard radiation are heated, and the water is returned to the boiler by an equal number of returns. There are usually two risers and two returns for each four apartments but each apartment has a thermostat in its living room controlling the flow of hot water by means of a modulating valve placed in each loop.

(3) Combination of outdoor controllers and room or apartment thermostats to be used with radiant heating. The two new City Investing Co. apartments in New York City have radiant heating and individual room thermostats—two firsts in the apartment field.

The buildings are divided into two zones, North and South, and each zone has two circuits, *A* and *B*. The *A* circuits supply water to the ceiling slabs of each room which are located near the exposed portions of the rooms, while the *B* circuits supply the ceiling slabs of each room which are located away from the exposed parts. Each of the four circuits (two *A* and two *B*) has its own set of controls to regulate the temperature of water being circulated, and each room has an individual pneumatic thermostat that controls a modulating pneumatic valve in the common room return for circuits *A* and *B*.

Operation of Controls

The controls and general explanation of their operation are best described in Fig. 1.

Referring to Fig. 1, the outdoor controller T-2 automatically starts circuit *A* circulating pumps when the outdoor temperature drops below a predetermined level of, say 65F. On a rise in outdoor temperature above this predetermined level, circuit *A* pumps automatically are shut down.

As the outdoor temperature continues to drop below 65F the outdoor controller T-2 automatically resets through panel P-1 zone water temperature controller with its temperature sensitive element located in the discharge line from the circulating pump in accordance with a predetermined schedule and as a function

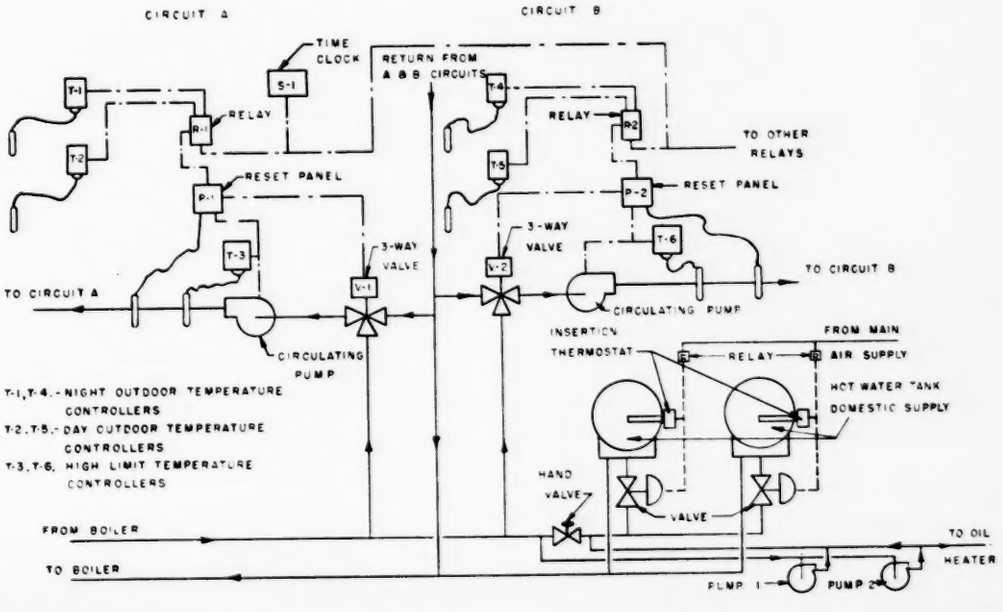

Fig. 1. Schematic diagram of the controls for north and south zones. Electric wiring is indicated by dash lines.

of outdoor temperature. Circuit *A* schedule operates approximately to vary the water supply temperature from minimum setting with 65F outside to its maximum setting with 35F. The reset controller in panel P-1 automatically positions the zone three-way mixing valve to vary the amount of return water and boiler water as required to maintain the water temperature circulating with the *A* circuit at the control setting of this instrument and as established by the outdoor controller T-2.

With respect to the outdoor controllers and reset controllers, the schedule adjustments are completely flexible so that any schedule of water circulating temperature as a function of any schedule of outdoor temperature may be set up within the control range of the instruments to meet the system requirements.

For lowered night temperatures of the zone circulating water, time clock S-1 through relay R-1 automatically transfers the submaster reset controller in panel P-1 from the control of outdoor controllers T-2 to outdoor controllers T-1. Controller T-1 functions exactly the same as controller T-2 but is set at a lower schedule so that during the night lowered-temperature period, water will be circulated at approximately 10F lower than normal day temperature. At a pre-determined time in the morning the reset controller in panel P-1 will automatically be transferred back to the control of the outdoor controller T-2.

The control function of the *B* circuit water temperature is identical to that outlined for the *A* circuit with the following exceptions: Where the outdoor temperature drops below approximately 35F, the *B* circulating pumps are started by an auxiliary switch located on valve V-2. The circulating pump is stopped automatically when the outdoor temperature rises above the 35F by outdoor controller T-5. The water temperature schedule for the *B* circuit will be at the minimum setting with a 35F outdoor temperature and the maximum setting with a 0F outdoor temperature.

For high limit safety control and to prevent water from being circulated in any circuit at temperatures above approximately 140F, controllers T-3 and T-6 with their temperature sensitive elements located in the water discharges from the circulating pumps, automatically shut down the circulating pumps when the water temperatures reach their temperature settings. A high limit controller is provided in each circuit in each zone.

The control system for domestic hot water is pneumatic and in each hot water storage tank there is an immersion type controller. Each controller operates its respective normally-open-type valve located in the hot water supply line to its respective hot water tank and operates to maintain the domestic hot water in the storage tank at the temperature setting of the immersion aquastat or controller.

In the City Investment Co. structures, individual pneumatic room thermostats are located in all living rooms, dining rooms and bedrooms as well as doctors' offices, reception rooms and elevator halls. The thermostats, which have no thermometers, are equipped with adjusting dials marked "warmer" and "cooler." Each thermostat operates its respective normally-open type valve.

Means are provided through a relay and timer to automatically shut down the air compressor during the lowered night temperature period, if desired.

As a means of providing alarms in case of failure, the following features have been incorporated in the control system: (1) a pilot light and relay are installed in each zone boiler room panel box, the pilot showing red in case of a power failure to the controls; (2) each of the 4 3-way mixing valves is equipped with a bracket on which has been mounted a pilot light, a bell and a switch. The bell rings and the pilot light shows red when the high limit controller shuts off a pump due to high temperature. The switch provides a means of turning off the light and the bell.

Automatic controls have been developed for each individual need in the apartment house field. The equipment is designed to provide the maximum comfort and economy under varying conditions and not simply to pump heat into a building regardless of requirements.

Experiences of numerous apartment house operators have demonstated that these tailor-made installations (1) protect the building investment by assuring long-term tenancy; (2) save money in the over-all operation; and (3) give tenant satisfaction.

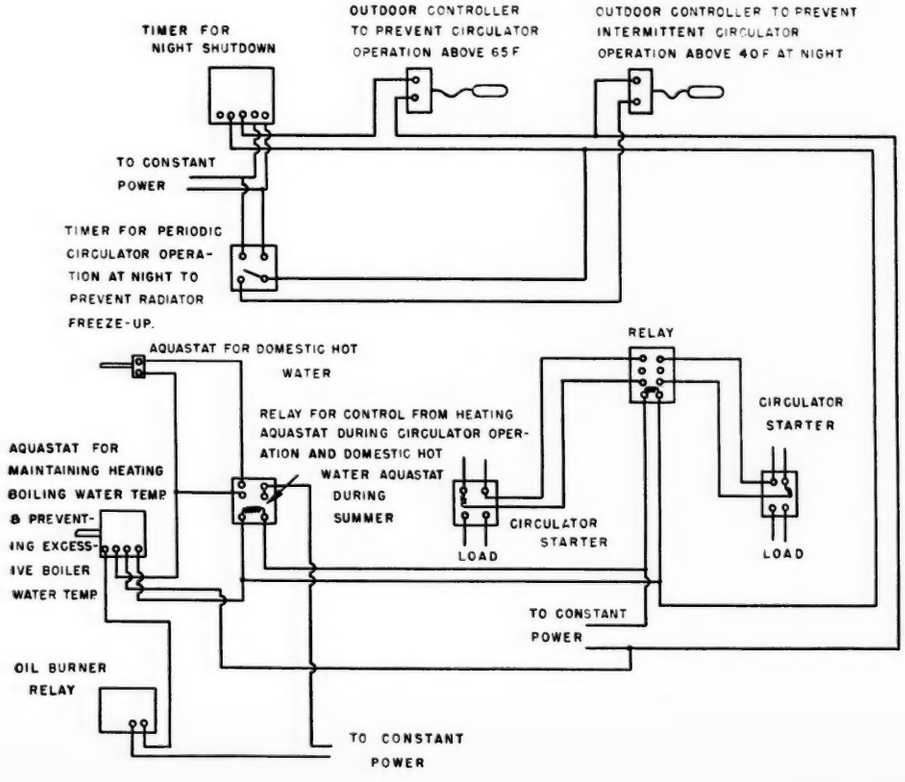
TIMER FOR NIGHT SHUTDOWN
OUTDOOR CONTROLLER TO PREVENT CIRCULATOR OPERATION ABOVE 65 F
OUTDOOR CONTROLLER TO PREVENT INTERMITTENT CIRCULATOR OPERATION ABOVE 40 F AT NIGHT
TO CONSTANT POWER
TIMER FOR PERIODIC CIRCULATOR OPERATION AT NIGHT TO PREVENT RADIATOR FREEZE-UP.
AQUASTAT FOR DOMESTIC HOT WATER
RELAY
CIRCULATOR STARTER
RELAY FOR CONTROL FROM HEATING AQUASTAT DURING CIRCULATOR OPERATION AND DOMESTIC HOT WATER AQUASTAT DURING SUMMER
AQUASTAT FOR MAINTAINING HEATING BOILING WATER TEMP & PREVENTING EXCESSIVE BOILER WATER TEMP
CIRCULATOR STARTER
LOAD
LOAD
TO CONSTANT POWER
OIL BURNER RELAY
TO CONSTANT POWER

Fig. 2. Schematic diagram of controls in Town Hall Village, Nutley, N. J.

Personal Weather System for
Air Conditioning Multi-Story Buildings

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Engineering and operating features of one of the means employed for air conditioning multi-story buildings. Article is one of a series which covers systems used for the air conditioning of such buildings.

THE Personal Weather System, which was designed for the air conditioning of multi-story buildings, is also applicable to smaller buildings requiring individual room or zone temperature control. The system in any of its form may be used for winter, summer or year-round air conditioning.

The most important distinction between the Personal Weather System and similar ones on the market is that the ventilation air may be brought into the building in any one of three ways shown in Fig. 1. The lowest cost or most suitable method may be chosen by the designer. The three methods are:

(A) Through the wall to each unit.

(B) Through a conventional low pressure low velocity power-saving duct system.

(C) Through a high-pressure, space-saving conduit steel duct system.

With Method *A*, latent and sensible cooling, filtering, positive air circulation and ventilation are accomplished by the room air conditioner which is supplied with chilled water in summer and heated water, mixed with anti-freeze, if necessary, in winter.

Method *B* is identical to Method *C* except that a conventional low pressure, low velocity galvanized duct system is employed to distribute the ventilation air to the room air conditioners or to sidewall supply grilles.

With Method *C* the sensible heating and cooling functions are separated from the ventilation, humidifying, and dehumidifying functions. Sensible heating and cooling are accomplished by the room air conditioner. Ventilation, humidification or dehumidification, and removal of building conduction load are accomplished in a remote control plant air conditioner by treatment of the ventilation air. The treated ventilation air is supplied at high velocity and 4 to 8

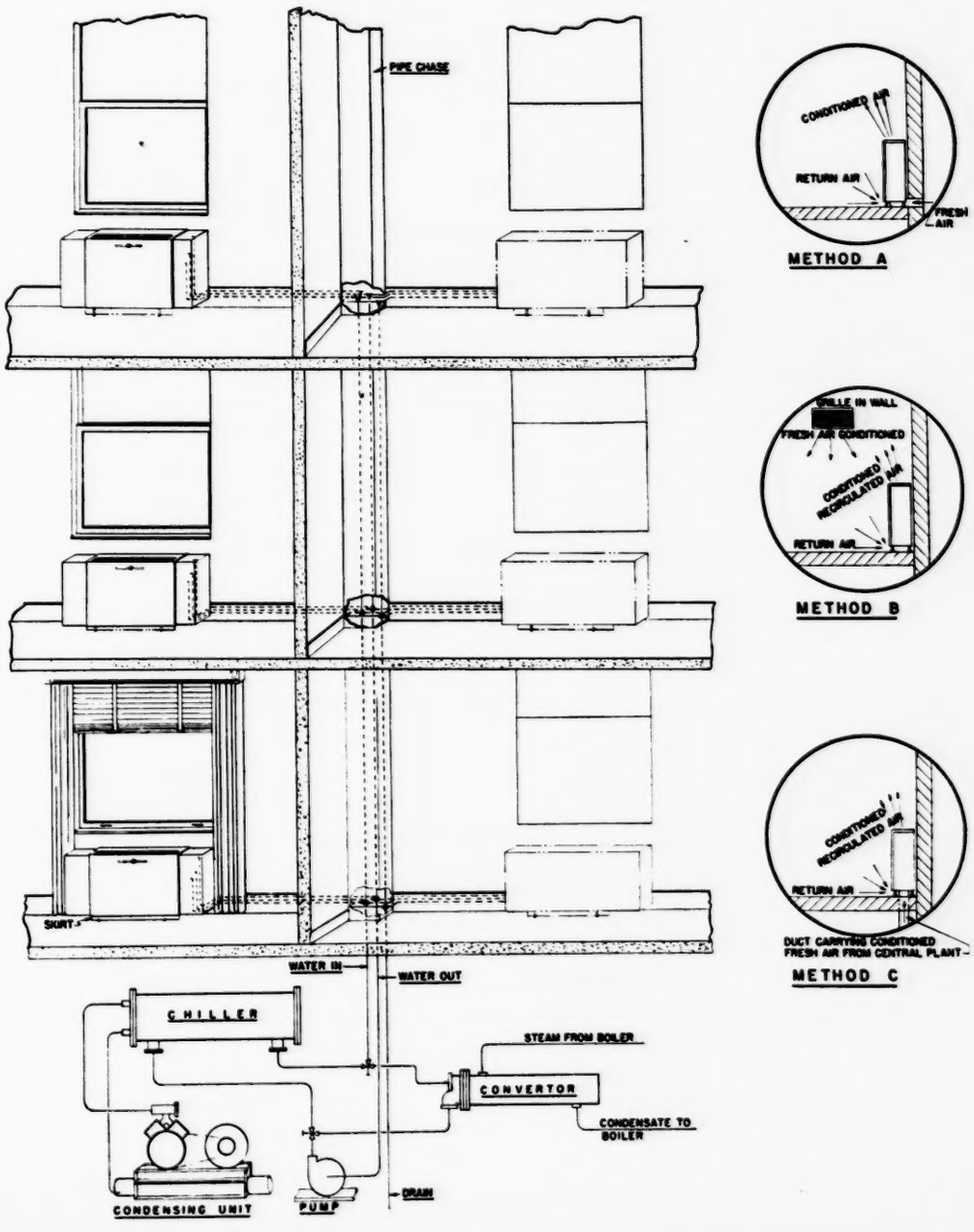

Fig. 1. Three methods by which ventilation air may be brought into a building having a typical system.

in. initial static pressure to the bottom of each room air conditioner through a system of small diameter, pressure tight steel conduit. The treated ventilation air mixes with room recirculated air in the room air conditioner and is delivered to the room.

Ventilation Air Eqiupment — A centrally located apparatus preconditions the ventilation air circulated to the room air conditioners. The conditioned ventilation air has four functions: Ventilate, dehumidify in summer, humidify in winter, and remove conduction heat gain year round but exclusive of solar heat in summer.

The centrally located apparatus employs functional elements of conventional air conditioning systems to clean, pre-heat, re-heat, filter, humidify, dehumidify and move the ventilation air. The only difference is that for the conduit system special fans are selected for the higher pressures, and down-stream sound absorbers are used.

Room Air Conditioner—The room air conditioner as installed has a single fan motor, direct connected to two fans. It is used to control air motion in the room. The same motor coil is used for cooling in summer and for heating in winter.

Water Piping System—A balanced reverse return, 2-pipe water distribution system is employed for supplying chilled or heated water to each room air conditioner. Water piping is normally zoned according to sun exposure with one pump and one set of controls per zone. Normally all water piping is insulated.

Refrigeration Equipment—Conventional reciprocating or centrifugal compressors are used with Freon refrigerants for cooling the water or brine to be circulated to the ventilation air system and the room air conditioners.

Heating Equipment—Any of the conventional methods of heating water are used in winter. The most common is the use of high or low pressure steam in a heat interchanger to heat the water pumped to the primary air system and room air conditioners.

There are numerous ways to control, zone, and pipe a Personal Weather System. Many installations are entirely manual, others have a few automatic features, and still others are completely automatic. No attempt is made here to discuss these various schemes in detail and the final decision is up to the purchaser and the engineer.

For the purpose of discussion consider a simple single zone system, Fig. 2, with automatic room temperature control year round and with ventilation air supplied by Method *C*.

The system of control illustrated in Fig. 2 compensates for variation in building conduction gain or loss by varying the ventilation air temperature. Compensation for sun and internal load changes is accomplished by automatic valves on the room units which vary the amount of water circulated through these units. These automatic valves may be selected to change from summer to winter operation on a variation in branch line pressure to their thermostat, T1.

Summer Operation—In summer the water heater is valved off and the by-pass opened. The pump circulates water through the water chiller, the cooling coil, and the room air conditioners in series. The water temperature is controlled by thermostat T5 to give the desired ventilation air dew point temperature. Each room is equipped with a room thermostat which modulates the flow of chilled water through the room air conditioner coil to control room temperature.

Winter Operation—For winter operation the cooling coil and water chiller are valved off and the heater circuit opened. Water temperature is maintained by aquastat *A* controlling valve *V*. Room temperature is held by the room thermostats modulating the flow of hot water to each room air conditioner.

The ventilation air system operates independently of the room units to temper, humidify and reheat the ventilation air to control building humidity and offset building conduction loss exclusive of solar heat.

The Personal Weather System meets the requirements of multi-story building air conditioning systems in several important respects: Positive ventilation with a choice of three means for obtaining it; better control of comfort conditions throughout the year; draftless air distribution, recirculated room air and ventilation air both filtered; low maintenance and flexibility for required tenant changes.

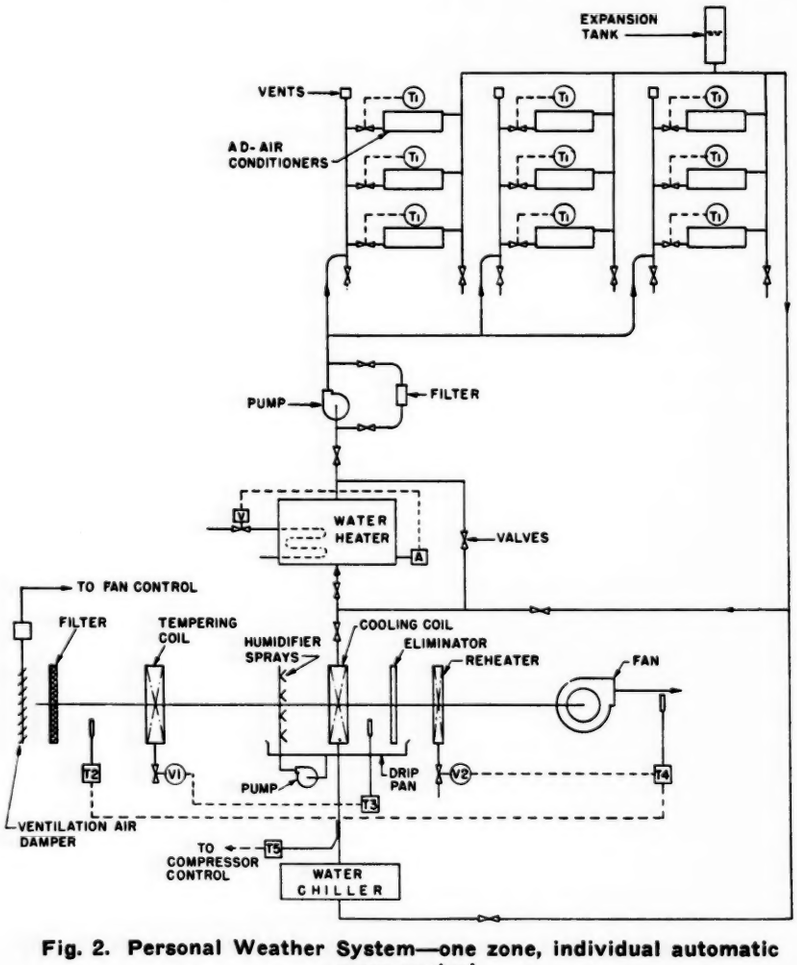

Fig. 2. Personal Weather System—one zone, individual automatic room control.

Building Shape vs Heating Efficiency

A. J. MAHER

An analysis of the influence of building shape to heating efficiency and steam consumption.

FOR many years I have calculated and studied the cost of heating modern buildings, from the viewpoint of the operator and also as the designer of heating system controls. During this time I and many others have devised numerous heat consumption graphs and tabulations for various types of structures and heating systems, with the objective of establishing a sound basis for comparison between the heating costs of two or more buildings. Although they were comprised of all the usual elements of weather, size, use and equipment, they generally failed to substantiate the difference in heating costs and proved feasible only to detect deviation from year to year.

Recently, in unofficially discussing the means for reducing the cost of designing, equipping and operating school buildings, I inquired whether there was any study made of the relation between the shape of a building and the cost of heating it. It seems to be the planned policy of school designers to favor the design of the 2- or 3-story type building that occupies greater ground area. I believe this trend in design could be unknowingly carried to an extreme that would greatly increase the cost of heating. The minimum amount of steam required to heat any building, would be the amount required to replace the heat lost through windows, walls and roof. Therefore, the most economical building design, relative to heating, would be the one with the most usable floor area or volume per square foot of outside surface.

To enable engineers to more readily weigh this condition, I propose that a factor or rating should be calculated for each building, which would represent the departure from what may be described as the maximum geometric thermal efficiency. This rating could be computed from the following equation:

$$\text{Percent geometrical thermal efficiency} = \frac{(\sqrt[3]{\text{volume, cu ft}})^2 \times 5}{\text{outside surface, sq ft}}$$

It may appear that this would restrict the architect to a cube or hemisphere shaped building but when you compare buildings with the same volume or floor area and different shape, as in Table 1, it will be seen that there can be quite a departure from a cube.

To roughly illustrate the use of this rating to compare the steam consumption of existing buildings, presume that the buildings in Table 1 were operating at maximum efficiency, were constructed of similar materials and identical coefficient of heat transmission, and that they all used 100 lb of steam per square foot of outside area to replace heat losses. The proposed rating in Table 1 column 7, can be used to compare the steam consumption of these buildings by using it as a multiplier as shown in Table 2, where columns 4 and 5 are transformed to a theoretical or more comparable consumption in columns 7 and 8.

The theoretical steam consumption rates in columns 7 and 8 of Table 2 indicate that the heating system has been operated efficiently. Columns 4 and 5 of this table show a variation of 30 percent in the customary factors of unit fuel consumption on both of two different bases—cubic feet and square feet.

Owners and operators of commercial buildings are vitally interested in the relation of rentable floor area to total floor area or volume, before the design of a building is approved. Office building operators do not favor a cube shaped building because it contains a vast amount of floor area in the center that is not very desirable for tenants and is beyond the requirements for serv-

(Concluded on page 144)

Table 1—Geometrical Thermal Efficiency Rating

Building	Width, Ft	Height, Ft	Length, Ft	Volume, Cu Ft	Floor Area, Sq Ft	Geom. Thermal Eff. Rating, %	Heating Loss, %
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	100	100	100	1,000,000	100,000	100	None
B	50	100	200	1,000,000	100,000	83	17
C	100	50	200	1,000,000	100,000	100	None
D	50	50	400	1,000,000	100,000	77	23

Table 2—Analysis of Steam Consumption

Building	Outside Surface, Sq Ft	Steam Consumed, Lb.	Lb Steam per Cu Ft	Lb Steam per Sq Ft	Geom. Thermal Eff. Rating, %	Theoretical Steam Consumption	
						Lb per Cu Ft	Lb per Sq Ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	50,000	5,000,000	5	50	100	5	50
B	60,000	6,000,000	6	60	83	4.98	49.8
C	50,000	5,000,000	5	50	100	5	50
D	65,000	6,500,000	6.5	65	76	4.94	49.4

Graphical Determination of Heat Transfer Film Coefficient for Methyl Chloride Vapor

B. F. RABER* and F. W. HUTCHINSON**

THIS article is the fifteenth[1] in a series giving graphical solutions for the inside and outside film coefficients of heat transfer for refrigerants being heated or cooled in liquid or vapor form, either within a pipe or flowing outside and normal to a pipe. The present article is for non-condensing methyl chloride vapor. Fig. 29 and 30, for inside and outside, respectively, give coefficients as a function of the weight velocity of the vapor, the temperature, and the diameter of the pipe or tube. It will be noted that for this refrigerant vapor there is no difference in film coefficient—at fixed fluid temperature—whether the vapor is being heated or cooled.

The dashed example line on Fig. 29 shows the method of using the graph: For vapor travelling within a thin-walled ¼-in. tube, enter the graph at the base scale at a point corresponding to the known weight velocity; from this point rise vertically to intersection with the horizontal line which corresponds to the known inside diameter (in the example it is assumed that the tube wall is thin and that both nominal and inside diameters can, with adequate accuracy, be taken as ¼ in.). From the point of intersection with the diameter line, follow the radial directrix lines up to intersection with the base scale and from this point rise vertically to intersection with the horizontal temperature line corresponding to the thermal condition of the vapor within the tube; from this intersection follow back down the higher set of radial directrix lines to intersection with the base scale at the correct value of the film coefficient of heat transfer. Thus, in the example, vapor flowing at a weight velocity of 9 lb per (second) (sq ft) through a ¼-in. pipe at —50F fluid temperature is found to have an inside film coefficient of 17 Btu per (hr) (sq ft) (F).

Examination of Fig. 29 will show that the influence of temperature on film coefficient is quite significant; thus, for the case given in the example, if all other conditions remain the same but the temperature of the fluid is increased from —50F to 300F, the film coefficient will increase from a value of 17 to approximately 30, an increase of over 75 percent.

Fig. 30, for methyl chloride vapor (non-condensing) outside and flowing normal to a single pipe is used in the same way as Fig. 29. The dashed example line shows the method of solution for a case in which vapor at a weight rate of 18 lb per (sec) (sq ft) flows normal to a ¾-in. outside diameter pipe and with a fluid temperature of 100F; the resultant value of the outside film coefficient of heat transfer is seen to be 33 Btu per (hr) (sq ft) of outside pipe surface per 1F temperature difference between the fluid and the outside wall of the pipe. The outside film coefficient is, of course, for convective transfer only; in cases where the pipe passes through a shell which is maintained at some other temperature—as, for example, the temperature of the ambient fluid—there will be a parallel loss or gain of heat by radiation. The radiant transfer can be evaluated independently or can be expressed in terms of an equivalent radiation coefficient and added to or subtracted from the convection film coefficient; the latter method is the more simple of the two in all cases where the pipe surface temperature is not initially known, but is to be determined.

The limitation in use of Fig. 29 and 30 due to inadequate turbulence can be readily evaluated by noting an approximate, but slightly conservative, relationship between the pressure and the minimum permissible value of the weight velocity. For Fig. 29 the criterion of adequate turbulence is the requirement that the weight velocity exceed 0.5 at 0 lb per sq in. gage, that it exceed 1.75 at 100 lb per sq in. gage and exceed 2.50 at 200 lb per sq in. gage. Fig. 30 is always applicable to weight velocities greater than unity, but for cases where the weight velocity is less than this an acceptable criterion for adequate turbulence is that the Reynolds number be greater than 100.

In view of the fact that the film coefficients for vapors are very much less than those for liquids it follows that at any given transfer rate there will be a much larger temperature drop across the vapor film than occurred across the liquid film. This factor may be important in design in that the fluid temperature for use in the graphical solutions should be the temperature of the film and this will be approximately mid-way between the temperatures of the main body of fluid and the pipe surface. For cases involving high rates of heat transfer the difference between film temperature and main fluid temperature may be sufficiently great to require analysis, particularly when the fluid in question is being cooled rather than heated. For a fluid heating, use of the main fluid temperature will always lead to a conservative value of the film coefficient, but for a cooling fluid the departure will be non-conservative. Since Fig. 29 and 30 are for non-condensing vapors it follows that their use is limited to cases in which methyl chloride is being either superheated or desuperheated.

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[1]The first article of the series appeared in HEATING AND VENTILATING, December, 1944.

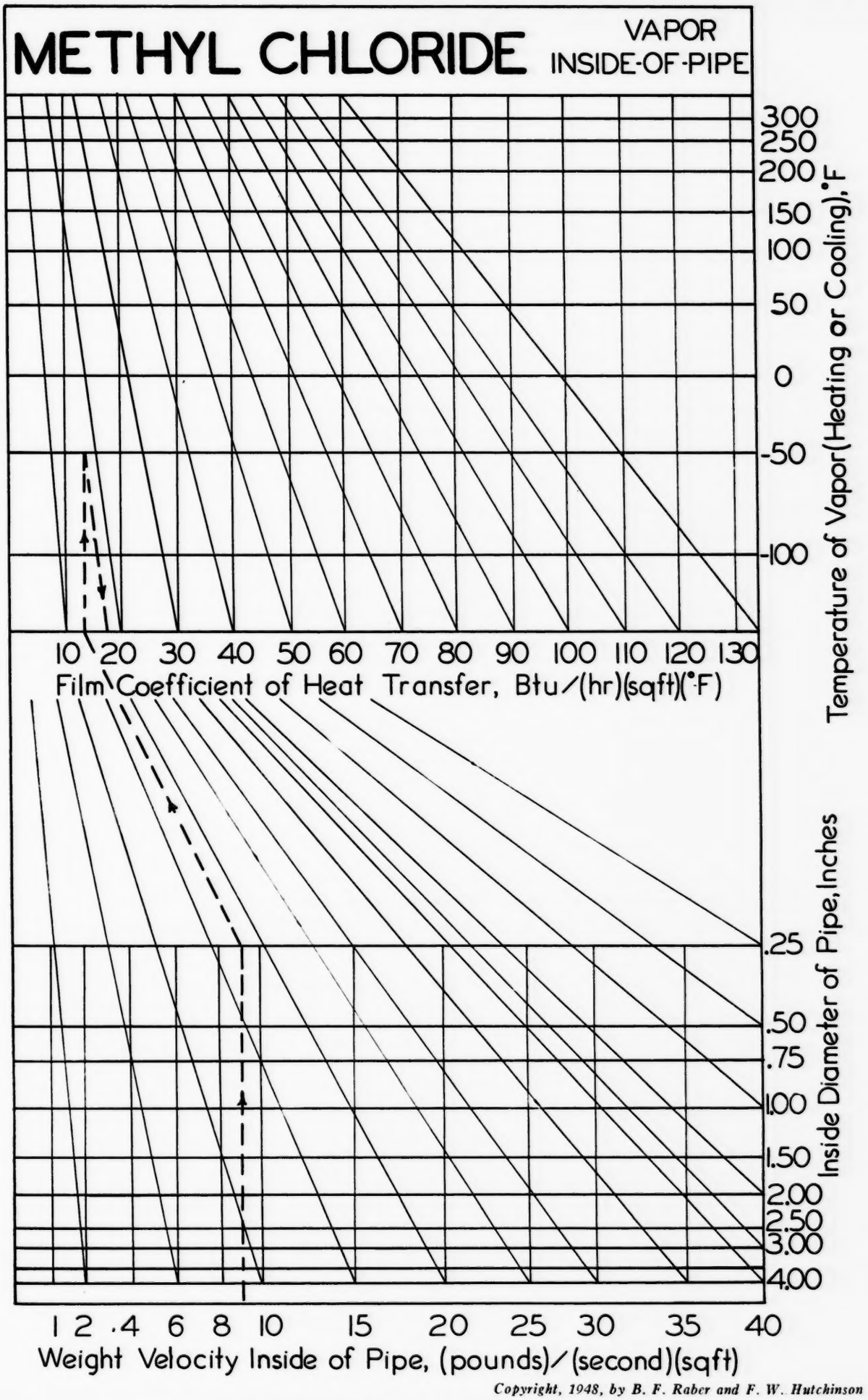

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Fig. 29. Film coefficient for methyl chloride vapor flowing inside a pipe.

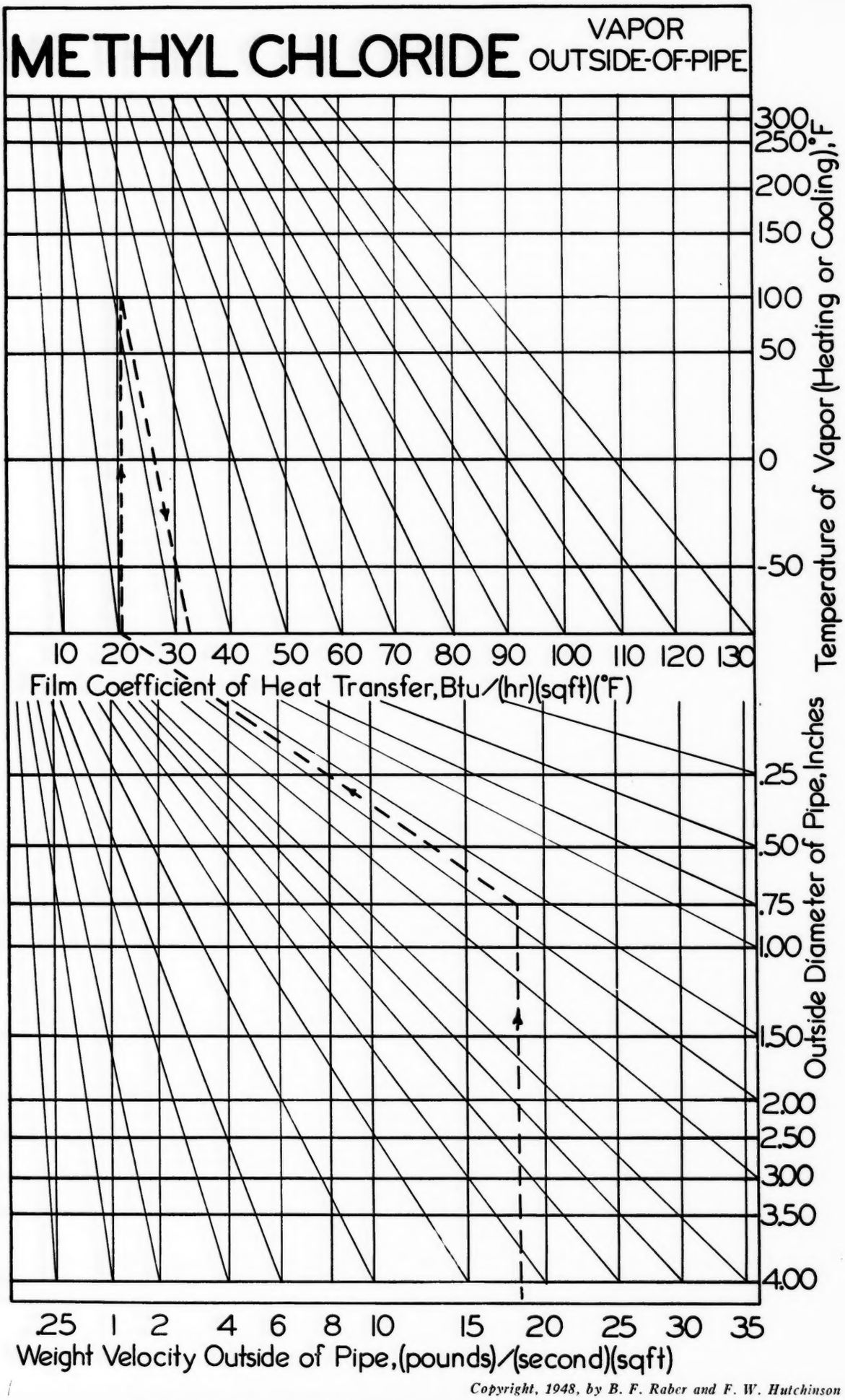

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Fig. 30. Film coefficient for methyl chloride vapor flowing outside a pipe.

Joints for Vitreous Tile and Concrete Pipe

J. E. YORK
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Details of joints and compounds commonly used for connecting vitreous tile and concrete pipe.

VITREOUS tile pipe is commonly used for house drains, house sewers and public sanitary sewers, and in many cities and towns it use for these services is required by ordinance.

This type pipe is furnished in even sizes 4 in. to 12 in. and with 3 in. increments in diameter up to 36 in. and in 2, 2½ and 3 ft lengths. It is made in single, double and triple strengths.

Joints are of the bell and spigot pattern with the bell end tapered slightly as shown in Fig. 1. Socket depths vary from 1¾ in. deep for 4 in. dia pipe to 4 in. deep for 36 in. dia pipe.

Experience of many years has demonstrated the permanence of vitrified clap pipe for sewers, but permanent piping with poor joints does not provide a satisfactory sewer system. Joints that are satisfactory must be water-tight and rust-proof. To insure such joints, careful consideration must be given to the materials to be used as a jointing compound.

Perfect Jointing Compound Characteristics

The characteristics of a perfect jointing compound have been very well defined as follows:

(1) *Adhesion and Cohesion* — The compound should form a strong permanent bond with the glazed surface of cold or damp vitrified clay pipe under all working conditions (adhesion).

Every particle in the compound should be permanently united throughout the mass to form a joint that will not break down or crumble (cohesion). This is absolutely necessary if the finished joint is to be sufficiently water-tight to withstand internal pressure.

(2) *Density*—When set, the compound should form a dense stable ring completely filling the annular space between the bell and the spigot of the pipe. There should be no bubbles or other holes through which leakage can occur.

(3) *Chemical Inertness* — The compound should be both acid and alkali-proof. Clay sewer pipe is completely unaffected by chemicals and the jointing compounds used with it should be equally so. Otherwise the chemical reaction of chemical wastes, sewer gas and aggressive soil waters will deteriorate the jointing material and permit leaks in the line. Chemical inertness is just as important in house drains and house sewers as it is in the main lines and collecting laterals, because many household wastes, drain cleaners and washing powders are strongly acid or alkaline in their reaction.

(4) *Flexibility*—The perfect jointing compound must have sufficient give or elasticity to permit movement of the pipe line during backfilling, or later by settling without cracking or breaking its bond with the pipe.

(5) *Quick Setting* — The compound should solidify quickly so that backfilling can be completed promptly without risk of damaging the newly poured joints.

(6) *Strength*—The jointing compound should be strong enough to permit jointing of pipes outside the trench, either vertically or horizontally without risk of the joints breaking while the pipe sections are being lifted or rolled into the trench.

(7) *Pressure Proof*—The completed joint should be able to withstand the same hydrostatic pressure as the clay pipe itself. It should also prevent infiltration of ground water.

(8) *Ease in Use*—The compound should be such that any experienced pipe layer can prepare it quickly and pour perfectly tight joints with a minimum of labor.

(9) *Inexpensive* — The cost of using the compound should be reasonable. Naturally a jointing compound that offers all of the above qualities will cost a little more than ordinary jointing materials but the difference in cost will be more than compensated for by the resulting permanence and freedom from trouble.

Types of Joints Commonly Used

There are several types of joints commonly used with vitreous tile pipe as follows: Cement joints; asphalt joints made without heating; hot poured joints; preformed joints.

Cement Joints

Cement joints are still the most commonly used joints for vitreous tile pipe. The joints are made with the tile in place.

Before making the joint it is essential to check the piping alignment and to see that it is properly bedded to insure against uneven settlement. Tile is commonly laid in such a manner that the spigot end of each piece of pipe will be on the downstream end of the pipe section. The joint is then made by first inserting a packing of best quality tarred oakum or hemp fiber

and calking this tightly into place at the bottom of the bell, leaving a space of not less than 2 in. from the packing to the face of the joint.

Before inserting the packing, check to see that the bell and spigot are reasonably clean. The remaining

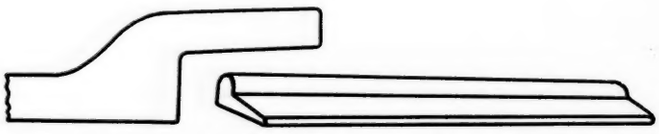

Fig. 1, left. Showing the slight taper of the bell and spigot pattern. Fig. 2, right. Wedge shape strip for confining asphalt compound to annular space of bell.

portion of the joint is then filled with cement mortar mixed in the proportion of one part cement to two parts of clean sharp sand, with 10% hydrated lime added.

The joint should be completely filled and a liberal fillet formed on the outside. A piece of cotton ducking, or unbleached muslin, having a width at least 6 in. greater than that of the bell, and a length to lap the outside of the bell by 4 in. should be tied tightly around the joints, and pressed firmly into place until the filling exudes.

Disadvantages of Cement Joint

Cement joints have the following disadvantages:

(1) The rigidity of cement joints in sewer lines does not allow for any settlement of the pipe or for deflection caused by backfilling. Any movement may break either the joint or the pipe.

(2) Water infiltrates through the cement itself owing to its porous nature and reduces the useful capacity of the line when the soil it wet.

(3) Because water can pass from the inside of the pipe through the pores of the cement, root growth and penetration will be encouraged in dry soils. After entering the sewer, the roots will continue to grow, causing obstruction or even complete stoppage of the sewer.

(4) It is difficult for cement joints to set with water in the trench.

Asphalt Joints Made Without Heating

With this type of joint, a ready made strip of asphaltic compound is used. This strip is wedge shaped as shown in Fig. 2.

When using this material the pipe should be placed erect on top of the trench with the bell end up. A strip of the proper length should then be inserted starting with the middle of the strip and continuing until the ends meet.

The strip should be pressed snugly back into the bell until its adhesive surface is in thorough contact with the inner surface of the annular space and the ends meet snugly.

After the strip is inserted, the pipe should be laid in the trench and by use of the mechanism shown in Fig. 3 the pipe is pushed home with a total horizontal pressure on the pipe from 2,000 to 2,500 lb. No calking of oakum or jute is necessary.

The fabric casing of the ready made strip holds the asphalt in shape, causing it, when the pressure is applied, to spread around the spigot end and to encircle the annular space of the bell. As the spread of the asphalt is restricted by the fabric casing, the pressure which is confined to the annular space forces the asphalt into every pore of the pipe, sealing even the smallest openings more effectively than the most careful calking.

Moreover, the asphalt is not squeezed into the barrel of the pipe. The resulting joint is shown in Fig. 4.

This type joint is easily made; it is water-tight, self centering, flexible and will not crack when the trench settles. It will not freeze, run, or slip and can be laid in any weather.

Hot Poured Joints

Three of the commonly used compounds for hot poured joints are described:

(1) *Cla Pipe Jointing Compound* is shipped in cans of convenient size all ready for the heater. No mixing is necessary. The compound as taken from the can should be broken into small chunks with a hammer and put into a heating kettle. After the inside of the bell and the outside of the spigot are wiped clean, the joint should be packed with jute in the usual manner. The compound is heated to about 350F or slightly higher and the joint is poured in the usual manner.

The compound pours easily when heated to the right temperature and fills the entire annular space without leaving bubbles or air pockets. The joint sets quickly, is strong, and is resistant to acid, alkali, and roots. Joints may be poured in either a horizontal or vertical position. When properly poured the compound adheres under the worst conditions to the glazed surface of the vitrified pipe.

Tests have shown that pulls in excess of 100 lb per sq in. are required to break the bond between the compound and the tile surface.

The jointing material is acid and alkali proof and even the strongest chemicals found in sewage or soil conditions do not affect it. The compound is also plastic. While to the feel and to all appearances the joint is as hard and rigid as the

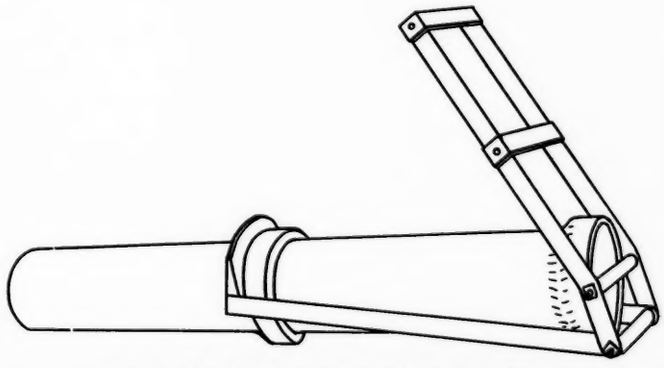

Fig. 3. Mechanism for pushing pipe home.

pipe, it has the plasticity to give sufficiently to avoid breakage or cracking should the pipe shift or settle.

The material can not be overheated. It changes color at different temperatures but this does not affect its efficiency in any way. After it has been poured, it sets rapidly and permits backfilling or handling of the pipe in about 30 minutes.

It successfully withstands pressures up to 55 to 60 lb per sq in. without leakage and, as moisture can not escape through it, roots of trees and bushes do not enter the sewer.

(2) *Type GK Pipe Joint Compound,* which has a bituminous base, melts and runs freely at a temperature as low as 250F. It adheres firmly to the glazed surfaces of the pipe and when cool has sufficient elasticity to permit a slight movement of the pipes without injury to the joints or breaking of adhesion of the compound to the pipes. It does not deteriorate when submerged in water or domestic sewage. It shows no deterioration when immersed for a period of five days in 1% solution of hydrochloric acid or a 5% solution of caustic potash.

The compound should be heated in a suitable heater to a temperature of 350 to 400F so that it can be poured rapidly and smoothly.

Before pouring, the pipe joint should be clean and dry and a gasket of dry hemp or jute should be calked in the annular space between the spigot and the inside of the bell. The gasket should be of sufficient thickness to hold the pipes securely in their proper relative positions and of sufficient length to go completely around the pipe. It should not fill more than one-quarter of the annular space.

After the jute is properly placed, a suitable asbestos runner, which has previously been dipped in soft mud or clay, should be placed around the barrel of the pipe and fastened so as to fit snugly against the end of the socket of one pipe and around the barrel of the other and form a pouring crater just off the center at the top. The heated compound should then be poured in so that it will run around the pipe, completely filling the annular space.

Some engineers require that the heated compound shall be poured off center on one side until there is evidence that the compound is completely around the pipe, at which time the pouring may be completed in the center.

Under suitable conditions two or three pipes may be jointed on the bank, care being taken to preserve the proper alignment of the pipe, both on the bank and while being lowered into the trench. Obviously this should not be done unless proper equipment is available to permit handling the jointed sections without excessive strain on the joints.

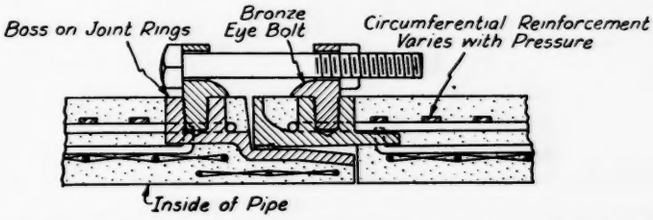

Fig. 7. Subaqueous reinforced concrete pressure pipe joint.

An important characteristic of this jointing compound is that while it has sufficient flexibility to relieve ordinary stresses caused by settlement in the line, yet it will not "cold flow" or sag out of the joint.

(3) *Tegul-Vitrobond* may be used for making acid-proof joints. This compound is a sulfur base cement to which has been added an olefine polysulfide for greater resistance to mechanical and thermal shock. Besides its inertness to acid, Tegul-Vitrobond resists erosion, abrasion and shock, has a high electrical resistivity, and absorbs less than 0.5% of its weight of liquid. This latter advantage eliminates salt crystallization such as that which occurs in the pores of absorbent cements. For this reason it lengthens the life of the joint.

Tegul-Vitrobond should be melted in a clean pot and should not be heated beyond 300F, as it will begin to thicken at that temperature. This condition is readily noticeable and can be corrected by removing the heat and stirring. On cooling below the thickening point it will again become thin and will flow freely. When too cool it will start to freeze over the top. The solution may be held in a molten state for one or two hours at a temperature just above the melting point (248F) provided the pot is covered. Flames must be kept away from the molten compound.

The joint may be yarned in the usual manner with jute or asbestos rope but a tighter joint can be obtained if these materials are not used and Alkor acid-proof cement is trowelled on the spigot end of the pipe instead, before it is shoved home. The Alkor mortar sets to a hard material in a short time and seals the base of the joint.

Pouring should be done at a good speed and continuously until the joint is full. As the jointing material cools and contraction occurs, resume pouring. In other words, the joint is completely poured before there has been any opportunity for

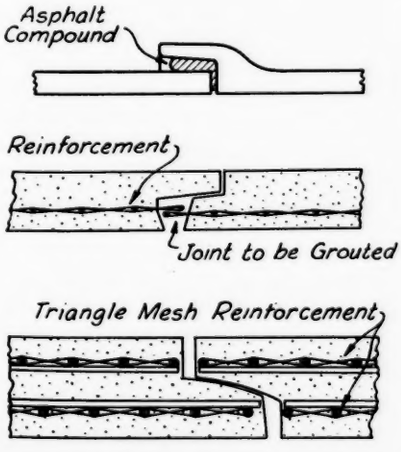

Fig. 4, top. Joint made with asphalt compound. Fig. 5, center. Details of Lock Joint pipe. Fig. 6, bottom. Joint where only fair tightness is required.

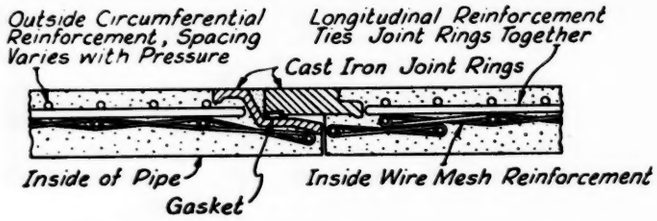
Outside Circumferential Reinforcement, Spacing Varies with Pressure
Longitudinal Reinforcement Ties Joint Rings Together
Cast Iron Joint Rings
Inside of Pipe
Gasket
Inside Wire Mesh Reinforcement

Fig. 8. Joint for centrifugally cast concrete pipe.

cooling. Pouring should be resumed as necessary to take care of any contraction in the joint material. Joints should not be poured unless the ground water level is below the bottom of the bell.

Preformed Joints

Slipseal die cast sewer joints are made with the aid of steel dies each consisting of two sections machined to a precisely tapered fit.

The pipe is placed upright, with the spigot end resting in and on the female section of the die. The male section of the die is placed inside the pipe bell; the two spaces between the die sections and the pipe are then poured with hot slipseal compound and the dies are released immediately.

The spigot will then have an asphalt collar and the bell end a similar lining, matching each other perfectly, and they are both completely exposed for inspection.

This part of the job can be done when and where most convenient.

Shortly before the pipe is to be laid, the collars should be painted with Slipseal solvent which softens and makes their surfaces gummy. The pipe is then placed in position, the spigot centering itself in the bell of the pipe previously laid, and shoved partly into place, facilitated by the tapered planes into which the collars have been cast.

The pipe is quickly aligned to grade, then shoved completely home. The solvent soon diffuses and the joint becomes one integrated whole, completely filling the entire annular space, perfectly bonded to the pipe and stronger than the pipe itself.

Slipseal joints are bonded to dry pipe before it is laid in the trench, and the final operation of the pipe may be satisfactorily carried on in wet ditches, water bearing sand or even under flowing water.

The compound has a melting point from 240 to 270F and a pentration of 4-7 at 77F in accordance with ASTM specification D5-25. It flows freely at 400F. No jute or other gasket material should be used.

Joints for Concrete Pipe

Reinforced concrete pipe is now used extensively for storm water sewers and nonsanitary drainage systems, and for water supply lines for pressures up to 400 ft head. Dense, rich well made concrete is generally recognized as a permanent construction material and water is the best seasoning agent for concrete. Since concrete sewers and water lines are constantly in contact with water, they offer reasonable assurance of durability.

As stated for tile pipe, a permanent piping material with poor joints does not provide a satisfactory installation. Joints for concrete pipe must, therefore, be tight, flexible and easily and cheaply made.

Joints for Standard Concrete Sewer Pipe, as manufactured by the Lock Joint Pipe Co., are shown in Fig. 5. When laying the pipe it is not necessary to excavate bell holes as the outside diameter of the pipe is constant.

The socket on the female end of the pipe and the spigot on the male end are each formed within the limits of the wall thickness of the pipe. A slight taper is provided on the contact surfaces of the joint to facilitate the insertion of the spigot end into the bell end, and when the pipes are shoved home, an annular space is left all around the inside of the pipe for the jointing compound. This space is so shaped that the jointing compound is wedged in place and after setting can not fall out.

A grout or mortar consisting of one part cement and two parts of sand is commonly used as the jointing compound. This is applied from the inside after the pipe is in place which makes it possible to backfill the pipe as laid and to make the joint later.

Joints for Water Intakes and Sewer Outfalls

Lock joint reinforced concrete pipe is especially well adapted for use on subaqueous lines such as water intakes and sewer outfalls. Pipe for this purpose is generally made in lengths from 12 to 20 ft which reduces the number of joints.

For sewer outfalls where reasonable tightness only is required, the joint shown in Fig 6 may be used.

Contact surfaces for this joint are shaped to provide a ball joint and the adjoining sections are pulled up tight and kept in place by means of connecting bolts, which pass through eye bolts anchored in the wall of the pipe near the ends.

The ball joint permits some flexibility in the line. Eye bolts and connecting bolts should be of noncorrosive materials. The degree of tightness for this joint is dependent on the close contact between the contact surfaces of the adjacent sections of pipe. No joint compound is required.

Where the greatest degree of water tightness is required, the joint shown in Fig. 7 should be used.

For this type joint, the standard pipe length of a section is 12 ft. Cast iron joint rings are securely anchored to the pipe when it is cast.

The male end has a spigot which is cone shaped to

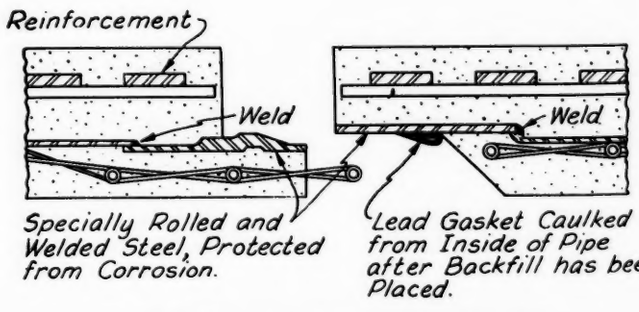
Reinforcement
Weld
Weld
Specially Rolled and Welded Steel, Protected from Corrosion.
Lead Gasket Caulked from Inside of Pipe after Backfill has been Placed.

Fig. 9. Method of joining cylinder pipe.

facilitate entry into the female end and when it is shoved home, it automatically calks a fiber filled lead gasket which is set in a groove near the outer edge of the female end. The joint is pulled up tight and is kept in place by means of connecting bolts passing through holes in clamps, which fit into grooves in the male and female end pieces.

Centrifugally cast concrete pressure pipe is made in 12 ft lengths, and is connected with the pipe joint shown in Fig. 8. This joint also provides for change of length in the pipe due to expansion and contraction.

Machined cast iron joint rings attached to the reinforcing rods are firmly embedded in the concrete pipe.

The cone shaped spigot end automatically calks the fiber filled lead gasket on the inside of the bell end. No bolts are used on this type of joint and the joint is automatically completely and permanently finished as the pipe is laid. The joint is flexible and standard 12 ft lengths may be laid to meet either vertical or horizontal curves commonly met with in water supply lines.

The minimum radius of curvature for standard 12 ft lengths of pipe varies from 675 ft for 36 in. dia pipe to 1,615 ft for 90 in dia pipe.

Cylinder pipe which is used for higher heads is made by forming a steel cylinder of proper dimensions, welding it along all of its seams and securely attaching the cylinder, either by welding or by mechanical means to the steel joint rings and then encasing the entire cylinder, both inside and outside with reinforced concrete.

A fiber filled lead gasket is calked from the inside of the pipe after the backfill has been placed, and the space between adjacent interior sections of pipe is filled with mortar, making a smooth continuous surface on the interior of the pipe.

This type of joint which is shown in Fig. 9 can not blow out under pressure, as all pressure tends to tighten the wedge.

References

For further information on vitreous tile pipe and concrete pipe the reader should consult the following material:

Cla Pipe Jointing Compound—Clay Products Association, Chicago, Ill.

Lock Joint Reinforced Concrete Pipe—Lock Joint Pipe Co., Ampere, N. J.

Materials of Chemical Construction—Atlas Mineral Products Co., Mertztown, Pa.

Sanitary Sewers—W. S. Dickey Clay Mfg. Co., Chicago, Ill.

Solar Energy to Provide Water Supply for Island

An ambitious attempt to harness the energy of the sun is to be made this summer to supply fresh water on the island of St. John, smallest and driest of the Virgin Islands. Salt water will be siphoned out of the ocean and fresh water distilled from it by the sun's heat. Up to now rain water has been the only practical source of fresh water on the island.

Some 125 solar distilling units, developed by Dr. Maria Telkes of the Massachusetts Institute of Technology faculty, will be installed on the island this coming summer. They are of a new type with a production quota of 1,000 gallons of fresh water daily. Looking like skylights, the units are 8 ft long by 4 ft wide and will be perched on elevations so that the fresh water will flow by gravity to a storage reservoir.

The units consist of a level concrete base with inch-thick insulating board. The upper surface is waterproofed with a black substance to absorb the sun's rays. Each unit will have a plastic cover to collect vapor rising from the sun heated pool and a basin a half inch to one inch deep to hold the salt water atop the blackboard surface. Troughs will be provided to collect the condensed vapor and to send it through pipes to storage.

Dr. Telkes who has conducted extensive experiments in the field of solar heat* and has collected considerable data on this subject, joined the Massachusetts Institute of Technology Solar Energy Utilization Project in 1939 as research associate. She is also engaged in thermoelectric research in the Department of Metallurgy.

During the war, Dr. Telkes developed a solar distiller for life rafts to produce drinking water from sea water.

Dr. Telkes, who supervised a series of experiments last year with a solar heated house at M.I.T., estimates the new units will have an efficiency of almost 60%. They will lose, she estimates, about 10% of the solar energy at the transparent surface of the salt water. She has not yet developed a perfectly black material. She estimates 4% of the energy will be lost at the pool bottom; 12% due to re-radiation from the top of the unit; 10% through the insulated bottom surface; 5% more through air circulation.

Experiments at the Massachusetts Institute of Technology indicate that a distillation unit with a tray area of 6 sq ft could produce more than a gallon of fresh water on a clear summer day, or two-thirds of a quart per square foot. In the tropics, however, Dr. Telkes estimates the distilled output of her units at a quart a day for each square foot of area.

"If the units produce as much water as we expect them to," says Garland Rounds, Federal Works engineer in charge, "we hope to install them throughout the island. For $15,000 we could place enough for all of St. John. Drilling a single well in St. John's volcanic rock would cost $5,000 and there would be the power cost for pumping. With the solar units all we'll need is a cheap pump to draw up 6,000 to 8,000 gallons of ocean water daily."—*F. N. Hollingsworth*

*Telkes, Maria, Solar House Heating—a Problem of Heat Storage, HEATING AND VENTILATING, Vol. 44, May, 1947, page 68.

Oil Burners Are Now Used in Korea

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Changes in heating design in Korea were brought about with the entrance of the U. S. Army in that country. Article describes former heating methods and a current oil-burning system.

AS part of the changes brought about in Korea by the American Army of Liberation, there has been a revamping of that country's heating methods. Instead of the customary maintenance of homes at 50F, the Koreans have heeded the American practice which calls for 70F when outside temperatures are zero.

Poor quality anthracite fines in the form of briquettes were used in South Korea; charcoal was burned in braziers for cooking and for local heating, as in shops. The coal used varied in heating value from 4,760 to 10,450 Btu per lb. Some shops and homes are still being heated in that manner. In Korea, in general, wood was burned to supply warm air to stone or clay ducts under the floors, a system that has been in use for centuries.

At present, oil has become available. This oil is of a No. 3 grade having a flash point of 155F, pour point of —40F, viscosity 38 SSU at 100F, and a heating value of 10,600 Btu per lb.

Under the Japanese influence during the past 40 years, there has been considerable adaptation of Western construction for office buildings, hotels and department stores requiring steam heating or forced hot air heating. Inside temperature is maintained at 50F.

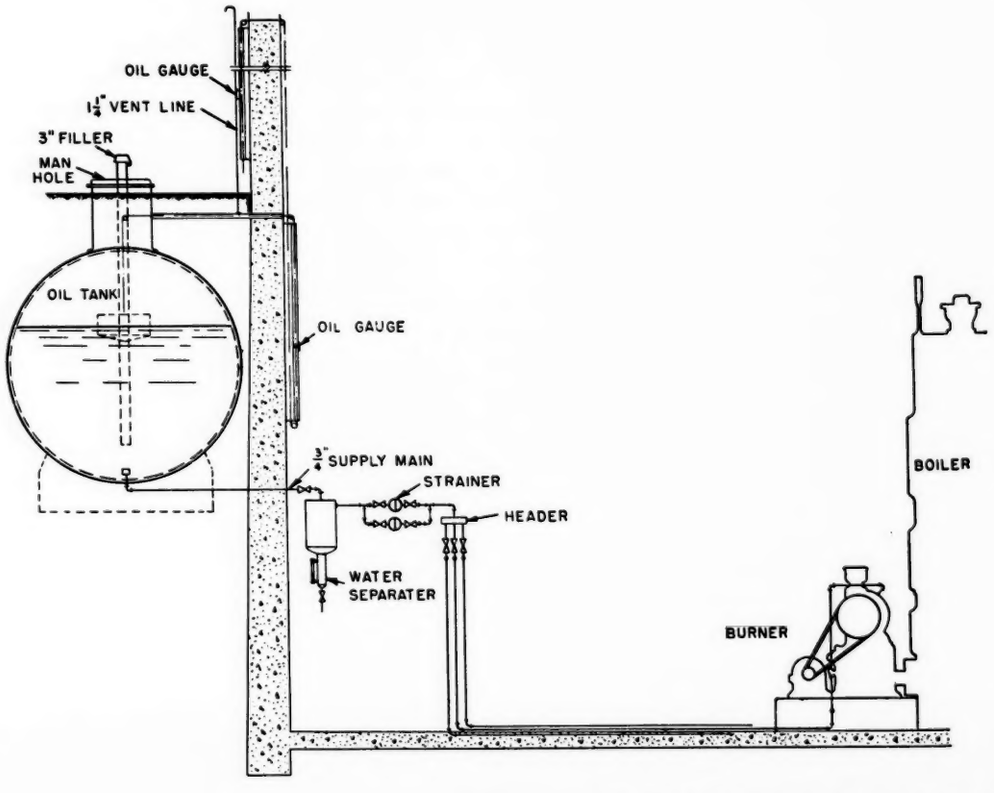
A typical type of fuel oil tank installation with a burner using low pressure air atomization is illustrated. The water separator is a necessary feature, for the oil that is delivered contains a considerable amount of water. The installation does not have safety or automatic features. Oil valves, air dampers and electric switches are manually operated by the attendant. Any one of the following reasons may be responsible for this: Controls manufactured in the Far East are usually unreliable due to poor design and materials; the native likes to tinker with these mechanisms and to take them apart; there is an abundance of men to operate such stations.

With motor operated air atomized oil burners, coal is used as a standby service in case of power failure, an interruption which occurs frequently.

Oil burning and boiler plant equipment are at present largely limited to what is available from manufacturers in Korea or what can be obtained from Japan.

The Koreans have developed a type of atomization in which air is pumped by a rotary compressor. Manually adjusted swing type burners are used which are ignited by a torch before swinging the burner into the boiler. These burners operate at 1.5 to 2 lb air pressure and about 35% of the total air supplied is used for atomizing the oil. Although the Korean design compares favorably with the process using steam, it is not as economical as oil atomization by mechanical means.

Even the method of insulating the steam pipe is unusual. The pipe is insulated by native rice straw rope coiled around the pipe and then covered with layers of asbestos cement. An outer protective jacket of burlap may be spirally taped on this, pinned at the ends. Because of the price of cotton duct, its use is prohibitive. Although silk would be a far cheaper substitute, burlap is the material normally used for this purpose.



Typical installation of fuel oil tank and oil burner.

THE SALES ENGINEER

Why Did I Lose That Order?

BERNARD LESTER
Sales Engineering Consultant

VERY few sales engineers ever admit openly that they lost an order for a fan, blower or air conditioning equipment because they did not do a good enough selling job. The reasons tacked on to lost business reports generally include high price, long delivery, unsuitable apparatus or customer prejudice.

Think of the enormous amount of planning that has preceded manufacture of every piece of apparatus we sell. Then consider how little planning often goes into making the order. Making the apparatus and making the order have one great difference. The apparatus 99% complete does not suddenly disappear as is often the case with the order. Yet every lost order has some "recovery value." The important thing is to make the loss of the order work for the sales engineer in creating future sales.

No salesman can afford to spend time brooding over lost orders. But before dismissing the loss of the order from his mind, he can well afford to spend some time studying why the business was lost, and what might have been done that was not done.

As important as learning how to improve sales methods, is the ability to capitalize on the loss of the job with the customer who may have future business to place. In bidding on a job and fighting for it, the sales engineer has performed a service for his customer. He has usually enabled that customer to buy under more favorable conditions. He has furnished competition. If he has done a good job up to the time the order is lost, not only is he in a position to call this to the customer's attention, but he is a better salesman for the fight ahead. He is in a better position to press his claim harder in the future.

Sometimes, of course, the sales engineer faces conditions that are close to impossible. He may not be able to offer suitable apparatus. His price may be away out of line. The delivery may be ridiculously long. Barring such conditions, however, the following are common causes for the loss of an order. All these relate to skill in selling.

A Late Start. This is a serious handicap, but often it can be overcome. One frequent reason for a late start is the fact that the sales engineer is not close enough to his customer's plant, personnel or improvement program. Losing the order, he finds that his competitor has done all the spade work before he got to work.

The Lack of a Simple and Direct Sales Plan. This is a very common weakness. Remember the apparatus, and the planning that has gone into its design and manufacture. Often when I have been driving out to see a customer with a sales engineer, I have asked him what his plan is for getting the order. Too often the answer is vague—sometimes just "Will get my bid in right and keep after it." Most successful sales have been "designed." Purchasers vary greatly—the plans must be developed to suit the particular conditions.

Insufficient Knowledge of the Equipment to be Sold. Based upon answers to many questionaires submitted purchasing personnel, this is the commonest weakness of the sales engineer. Incorrect answers, or no answer at all, destroy confidence and waste the time of purchaser and salesman alike. Character and prestige are lost. The sales engineer just gropes around. Not knowing his own apparatus, he seldom knows about that of his competitor. There is nothing on which to employ strategy in shaping the sales argument that relates to apparatus merit.

Past Difficulties with Equipment Sold or Service Rendered. Every sales engineer experiences trouble with apparatus or service sooner or later. To clean it up promptly and well goes a long way toward establishing confidence. Recently I heard an equipment official of one of the large automobile companies cite an instance where he was completely won over by the way a sales engineer met and handled a case of apparatus trouble. This official was determined to deal with this sales engineer in the future.

Failure to Spot and Reach the Right Man in the Customer Organization. Betting on the wrong horse is very common. But the sales engineer can find out, if he analyzes his customers carefully, just how apparatus is bought, and the degree of influence held by each person having to do with the purchase. Men down the line—without important titles—sometimes really make decisions.

Written Proposals Not Drawn up with Sufficient Care. The proposal represents the sales engineer when he is not there. It is often handed from one to another and may reach the hands of top officials in the customer organization. Completeness, brevity, systematic arrangement and neatness are big factors. Voluminous proposals should contain a summary making possible quick review.

Failure to Make Use of All Available Sources. "Did I make use of my company's technical men, when this complicated problem came up?" "Did I refer to this or that successful installation, when my apparatus was in question?" "Why did I not get the head of the neighboring bank to say a good word for me?" Such questions as these often arise to haunt the sales engineer *after* the job is lost.

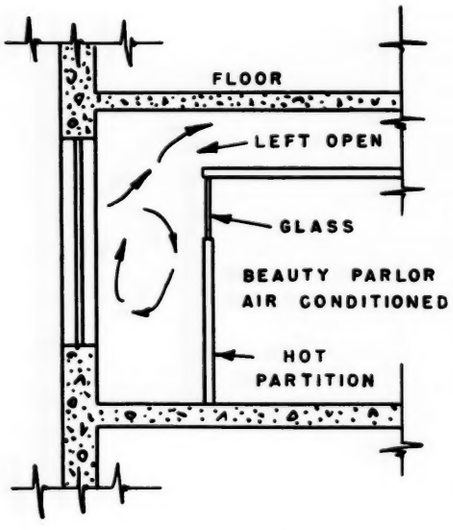
Experience is my Classroom

By T. W. REYNOLDS

NOT SO HOT

A beauty parlor had a partitioned-off space around the perimeter or window side of the room. This space concealed the various utilities or services to the booths and it was assumed that its partition would go from floor to floor. Such a method would confine the heat gain from wall and windows, therefore a considerable quantity of conditioned air was introduced into the booths as an offset to the hot partition. The reasoning was good, but the hot partition did not get as hot as assumed because the upper part of this partition was left out. Heat then flowed to a large extent over into the hung ceiling where the air conditioning ducts are located along the booths.

Considerable dampering down in the branch supply ducts is required to eliminate a condition of this kind. This upsets, to a certain extent, the air flow in the interior duct system where this system is tied in with the ducts to the booths. The best remedy is to carry the partition up, a method which will eliminate the heat gain of the ducts in the hung ceiling.



Sketch of condition causing overcooling.

Note: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

THE READY ANSWER

Modesty notwithstanding, the writer, for the sake of the point he wishes to make, cannot help but admit that he never was much of a hand at lying. Whenever he did indulge it would all end up in disaster. Yet one cannot help but admire the ready engineer who has instantaneous answers to all questions to which the client foolishly expects an immediate answer. Most questions do require quite some thought and research, yet if the answers are not immediately forthcoming your stock goes down with the client when it should go up due to your careful examination into the subject.

The ready engineer cannot possibly know the answers immediately. How, then, does he get away with it, and if he does, how does it work out in the long run? Does not the effort to answer everything that comes his way keep the ready engineer from thinking out the correct answers? Do first impressions then hold? Is not there a day of reckoning when the not so sure engineer comes in best at the finish? The writer has pondered all this, but must admit that there is much to be said for both sides of the question.

Much depends upon the particular ability of the engineer to handle questions as fast as they come. If he has the necessary abi'ity he probably can as a rule come out on top. His wits will often find the correct answer. Still other answers at random will by chance hit the nail on the head. Then there is the client who forgets the answer to his first question in his anxiety to ask a second question, and, of course, the answers to many questions have been forgotten by the time a job is finished because things may work out quite differently or even the reverse from the answers.

Perhaps the thing that saves the day in most cases is that the answers never come up for test. In the preliminary stages of design many things are proposed, such as building locations, their shapes, heights and other ramifications, all of which are much different in final approved schemes.

During this stage of the design one can safely state the area required for mechanical apparatus, the size of boilers and what not, for none of the information will be used in layouts ultimately voided. There will be a new building layout design each morning so there will be ample time to set down more accurate figures by the time things get more settled.

UPS AND DOWNS

You get the old smoke machine going. You are going to prove that the floor of the store is under pressure with the air escaping up the escalators. It is so—the air is found going up the up escalator. But wait, it is now found returning by way of the down escalator. Evidently, there was no pressure in the air conditioned spaces, so that the movement of the escalator carried the air along in the direction the escalator was going.

All of which reminds me of the two sets of trial steps we erected over the open cut on 50th St. and Park Ave. during the construction of the Grand Central Terminal. What was the proper rise and tread for stairways? We would find out by erecting two and having an observer note the usage of each. The observer kept the count, but added the words, "In each case, a party uses those steps which happens to be a few feet closer than the other steps, but as for the rise and tread, he can't measure the difference with his eye. Even if he could detect a difference he would still use the nearest steps."

People, however, will use one side of a stairway more than the other side for one reason or another. Witness the stairs from the street in the Commodore Hotel, New York City. They are all worn down on one side.

TROUBLE

It seems to be in the very nature of things to have trouble out on construction, no matter how hard we try to avoid it by thoughtful planning back in the office. Troubles may be inherent from the design, come about due to the method of construction, or too many field changes, but regardless of these things, the completed job that starts off without trouble, no matter how well managed, has yet to be built. While many troubles are due to obvious neglect, many others are of a nature never met before and cannot be foreseen.

There is always a period of adjustment during which the tempers of all are tried out. The more organizations or subs there are involved and the larger these organizations, the greater the difficulties. On the other hand, if everything has to clear through the general contractor, the de'ay and the chance of errors or omissions is multiplied with the transmittal of correspondence from one to another. All the blue prints with their many revisions must go to the general contrac-

tor for distribution. It's all good business for the blueprinter, but somehow each sub seems to be working from a different set of revised prints.

A TIGHT SQUEEZE

There was a boiler change to be made at a hotel in Lakewood, N. J. The engineer when asked about the condition of an existing boiler did not know, or possibly wanted to play a white collar engineer down. He said, "There is the boiler, help yourself." To which the writer, thus challenged, said, "I will, and with the help of your overalls hanging over there," but the engineer had trumped, so with overalls on, down the manhole the writer went once again. Now the idle boiler was not yet any too cool and having been dined and wined by the management did not help matters, in fact the last time previously that he had wined he never returned to the office, but wound up somehow with the purchase of a dress suit.

Conforming to the usual, when associated with wine, the middle of the writer swelled a bit as helped along perhaps by the heat. So the manhole seemed to have shrunk when the inspection inside the boiler was completed.

Stripped naked and applying the grease the engineer so kindly handed in, out slipped the writer, much to the engineer's amusement, leaving the overalls well behind for the engineer to fish out by himself.

DUST GETS BY

Some engineers specify a slow rate of rise electrical thermostat after an air conditioning filter. This thermostat is for shutting down the fan and closing dampers in the event of a fire in the system. Weather which changed from say 80 to 100F, would not affect this thermostat, but a fire would cause it to act in a few seconds. Some engineers also like to have the fan tied in with the automatic filter so that when the fan is started, the filter curtain will revolve and power will be on the curtain, if of the electronic type.

Best practice with a self cleansing filter is to keep the curtain running at all times. It takes a day for the curtain to make a complete revolution, meanwhile there would be enough air movement even in a shut down system to dirty the filter. Power, however, could be shut off the curtain whenever the fan stops.

A self cleansing oil filter should not be run without liquid as sometimes proposed on construction before the shipment of liquid arrives. Sometimes the fan is run during construction prior to installation of the filter. This certainly fills the ducts with dirt, plugs the registers, and soils the outlets and ceilings.

TRAGIC BLOTS

Inked-in tracings are not so much in evidence today. In earlier days the drafting room chief was usually German or Swedish, thoroughly imbued with drafting as an art, and a user of ink in all its colors. Bottles were put in holders, a protection against spillage, but usually the bottle in use found its lone way to where it was most convenient while tracing. Accidents due to spillage were sometimes tragic when months of labor were destroyed in a moment and construction seriously delayed.

One such accident occurred in connection with the track design for the Grand Central Terminal. Tracks had to clear columns which supported the building and overhead streets. Very accurate work was required for the turnouts and curves to maintain clearance at all points. To meet such conditions, tracing cloth was hung unrolled in the drafting room for weeks.

When so cured against excessive shrinkage, the cloth was spread the length of three very long drafting tables. The tables were secured together and a string stretched down their middle for plotting an accurate center line. Ordinates were worked out from this center line and the trackage developed by several engineers working the length of the tracing. One engineering draftsman removed an ink bottle from its safety mounting, set it down somewhere near the middle of things, then accidentally knocked it rolling along the center line of a tracing developed as described. The ink could not be fully removed; in any event the tracing became too badly warped for use.

In the office of D. D. Kimball, consulting engineer, New York, about 1914, we made the tracings of the Missouri State Capitol. Frank Thompson worked there then, and in retaliation for some horseplay of the moment, he threw an eraser at Ellis (the electrical engineer) and the writer. We ducked below our tables, but Ellis returned so quickly that he met a bottle of ink full in the face.

The bottle was hit square by the eraser. The color of the ink was green and so was one wall, together with the face and shirt of Ellis. A quick check of the tracings disclosed that final rebound of the bottle from the wall had distributed countless number of tiny pin points of ink on all tracings on the surrounding desks. We worked for days removing these spots by means of knife scratchers. Erasers would not do it.

TROUBLE HUNTING

Titanium tetrachloride is a liquid you cannot drink with impunity, but its a mightly fine thing out on the job for locating troubles from faulty air distribution. A few drops of the liquid applied to the cotton in the bottle will emit a dense smoke as air is forced past the cotton and will immediately show you where the air is or is not going.

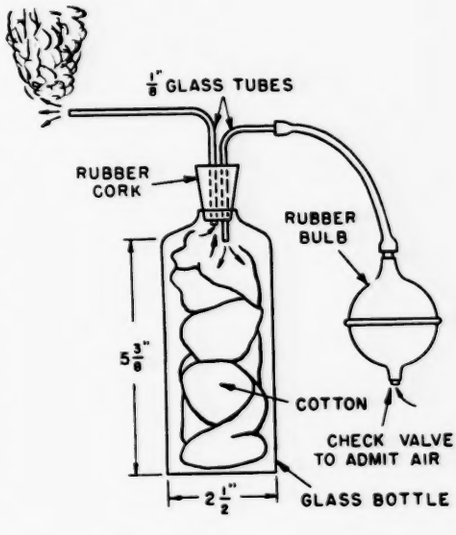
The liquid can be bought from any chemical firm and is not too expensive*, even when carelessly used in the more usual manner of sprinkling a rag with the solution and holding the rag in the air stream by means of a stick. Where economy and control is desirable, some home made device is best, such as the bottle and bulb illustrated in Fig. 1. Handling of the liquid otherwise will make droplets which smoke for a time on floors and clothing. Too much smoke might unduly alarm the public.

By means of this liquid and device one can soon tell whether the air is going or coming at doors, stairways, escalators and elevators, or prove that some supply outlet is directing air against a beam so as to deflect the air down on the occupant below.

The density of the smoke is such that even outdoors it still proves very useful. For examp'e, the odors from a neighboring kitchen may be traced by the smoke to the outdoor air intake of your own building.

Fig. 2 shows a smaller device which can be carried about in the pocket, but used upon occasion as a test of air movement. Prior to using this device the writer was smoking more cigarettes on test than was good for him. The outfit shown in Fig. 1 was an outgrowth of Fig. 2.

*A bottle of approximately the size shown in Fig. 1, the smallest quantity of liquid purchaseable, cost the writer $1.75.



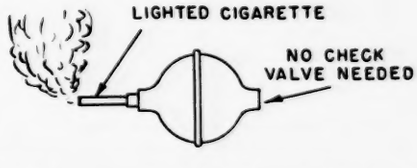
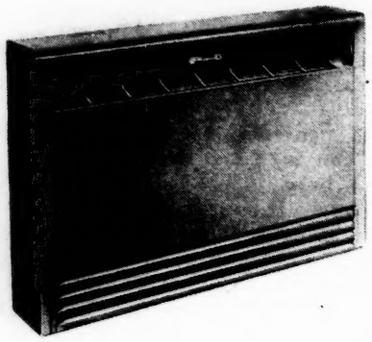


Fig. 1, upper. Sketch of smoke device. Fig. 2, lower. Air conditioning checked by the cigarette smoker.

NEWS OF EQUIPMENT AND MATERIALS

Convectors

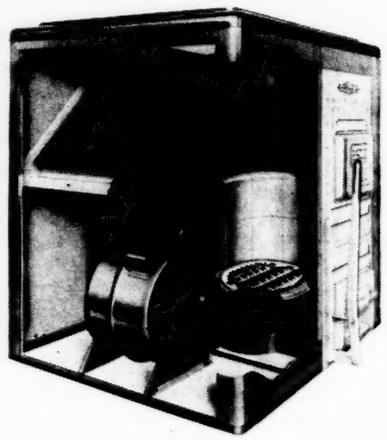
NAME—Modine convector radiation.
PURPOSE—Space heating.
FEATURES—Features of a new con-



vector line include a curved outlet air grille within the enclosure and a temperature control damper which is manually adjusted. When closed, as in non-operating periods, damper completely conceals the outlet grille and blends the enclosure with the adjoining wall. Front panel is easily removed for full access to the convector interior. Air vents for convectors installed on hot water systems can be located on the curved outlet grille. An optional lower grille snaps in and out of place. Heating element has copper or copper-alloy tubes, fins, headers and connections, and fins are permanently bonded to tubes.
SIZES AND CAPACITIES—Available in 4, 6, 8, and 10 in. depths; 18, 20, 24 and 32 in. heights; and in 10 lengths from 20 to 64 in., a total of 160 individual sizes.
LITERATURE AVAILABLE — Bulletin 248 and 248-A.
MADE BY—*Modine Manufacturing Co., Racine, Wis.* **219**

Multi-Fuel Furnace

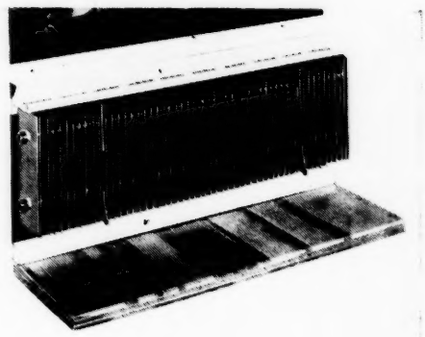
NAME—Stokol.
PURPOSE—Furnace that can be converted from hand-firing to stoker operation, or to oil or gas firing.
FEATURES—Unit is complete with slow speed centrifugal blower, heavy duty motor, variable speed drive and filters. Blower may be placed at either side of cabinet. Automatic temperature control sets are available for the hand fired gravity and forced air units. To convert from hand firing to oil or gas firing, fire and ash doors, grates and shaker assembly, refractory and support ring, and the chain regulator set and check damper control are removed. A conversion kit is installed consisting of observation door and burner mounting door, and a Stokol conversion oil burner or gas burner is placed. For conversion from hand firing to stoker firing, the ash door, grates and shaker assembly, and chain regulator set and check damper are removed. A stoker is then installed. Filters are of the



replaceable type. Motor, which operates blower, is designed for continuous operation and has thermal overload and low voltage protection.
MADE BY—*Stokol Stoker Co., 2060 Northwestern Ave., Indianapolis 7, Ind.* **220**

Baseboard Heater

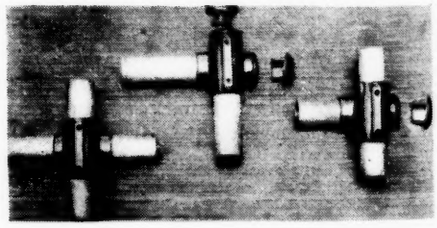
NAME—Rittling baseboard heating unit.
PURPOSE—Space heating.
FEATURES—Heating core is continuous copper tubing with aluminum fins. Unit is covered by a decorative heavy gage sheet metal grilled with warm air outlet and deflector. Tubes are ½ in. OD so that ½ in. type K water tube can be used as sweat fittings. Tube and fin assembly is furnished in lengths of 2, 3, 5 and 9 ft and can be joined by sweat fittings or compression fittings. Manifolds are supplied



for each end of standard lengths, to be used at each end of the completed heating element.
SIZES AND CAPACITIES—Heating capacity of 600 Btu per hr per lineal foot with forced hot water circulating at 170F.
MADE BY—*The Rittling Corp., 1292 Niagara St., Buffalo 13, N. Y.*...**221**

Rail Fittings

NAME—Nu-Rail slip-on fitting.
PURPOSE—For easy assembly of railing.
FEATURES—Fitting fits over the pipe and engages it by means of hollow point screws in place of conventional threaded pipe and fittings. An eccentric cross permits the pipes to cross each other without interference. By means of drive caps, the cross may also be used as an elbow or a tee. Fittings are made of an aluminum alloy which tests show, it is said, can carry weights up to 2,800 lb per fitting without screw slippage.
MADE BY—*The Hollaender Mfg. Co., 3841 Spring Grove Ave., Cincinnati 23, Ohio.* **222**

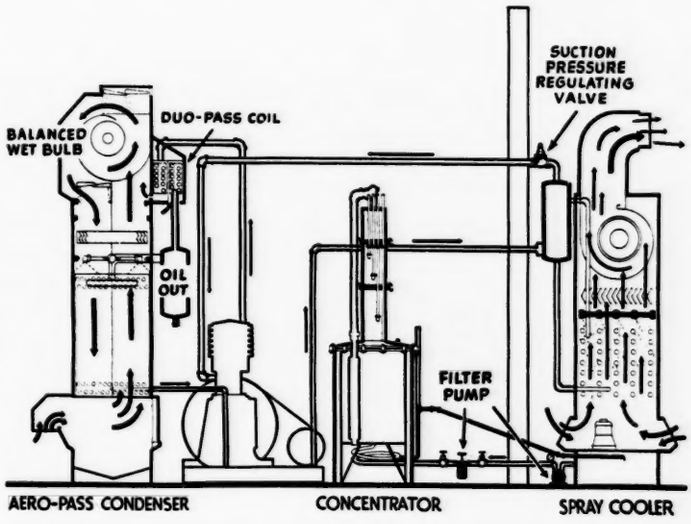


Refrigeration

NAME—Niagara No-Frost method of refrigeration.

PURPOSE—Refrigeration for space or products.

FEATURES—Equipment consists of Niagara fan spray cooler which chills air and distributes it as required, Niagara concentrator which maintains the proper concentration of the no-frost liquid, the Niagara Aero-pass condenser which condenses the refrigerant gas, and a compressor. Air is chilled through contact with coils and a recirculating cold spray of the no-frost liquid solution. As moisture is condensed from the air stream, the solution becomes diluted and is diverted to the concentrator which evaporates the excess water. Re-concentrated liquid is returned to the spray cooler so that a shut-down for defrosting is eliminated. A filter in the liquid line removes foreign material. A metering gear pump provides uniform delivery of liquid to the concentrator regardless of filter operation, and in proportion to the condensation taking place. When the pressure reaches 50 lb, the operation is automatically shut down by a pressure switch and a warning light signals the operator to clean the filters.



SIZES AND CAPACITIES—Suitable for installations having requirements of 10 ton refrigeration or more.

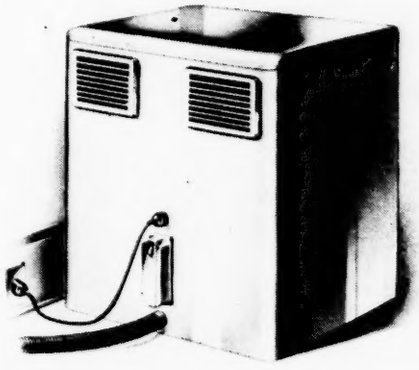
MADE BY—*Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.* **223**

Dehumidifier

NAME—DryNamic Dehumidifier.

PURPOSE—For reduction of relative humidity in storage spaces, stock rooms, basements and recreation rooms.

FEATURES—Units are automatic electrically operated solid adsorption desiccant dehumidifiers. Dry air is discharged from the unit into the space to be dehumidified and wet air is exhausted through a flexible hose line to the outside of the room. Control is available by means of a plug-in humidistat in the unit, which starts the unit at any desired relative humidity setting and breaks the circuit when the unit has reduced the humidity to set level.



SIZES AND CAPACITIES—Single bed Model Q unit with moisture removal capacity of 12 lb per day. Double bed Model QD unit 24 lb per day. The Q unit will maintain a dry atmosphere in spaces up to 5000 cu ft and the QD 15,000 cu ft, depending on desired final conditions and the tightness of the structure.

MADE BY—*Cargoaire Engineering Corp.; sold by Dry Air Products Corp., 726 Jackson Pl., Washington 6, D. C., and DryNamic Division, Cargoaire Engineering Corp., New York, N. Y.* **224**

Vibration Control

NAME—Elasto-Rib.

PURPOSE—Vibration and noise control.

FEATURES—A laminated rubber cork material consisting of a layer of cork is bonded between two layers of deep grooved oil-resistant, synthetic rubber. Ribbed contour of rubber is said to increase its isolation properties and to provide a non-skid contact with the floor.

SIZES AND CAPACITIES—Available in sheets up to 24 by 36 in. and 1 in. thick. Recommended load is between 7 and 21 lb per sq in.

MADE BY—*The Korfund Co., Inc., 48-15 32nd Place, Long Island City 1, N. Y.* **225**

Floor Furnace

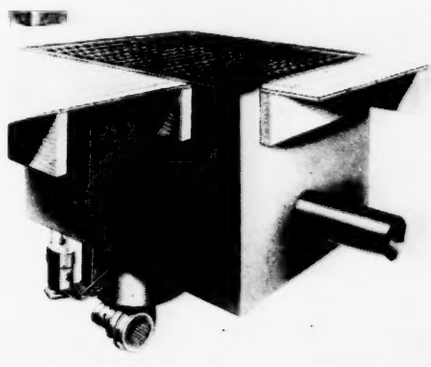
NAME—Gillen floor furnace.

PURPOSE—Space heating.

FEATURES—Oil flow is automatically controlled by a room thermostat but may be manually regulated by a floor level control rod if necessary. A constant level oil control with an anti-flooding device assures proper metering of the fuel to the burner. A safety limit control bulb prevents overheating. Entire unit may be lifted through the floor if servicing becomes necessary. A motor and blower arrangement provide a safety control air flow.

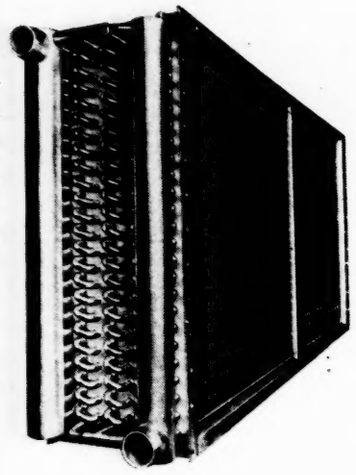
SIZES AND CAPACITIES—Height, 48 in.; length, 37 in.; width, 25 in. Output, 52,500 Btu per hr.

MADE BY—*J. L. Gillen Co., 2-4 E. High St., Dowagiac, Mich.* **226**



Cooling Coils

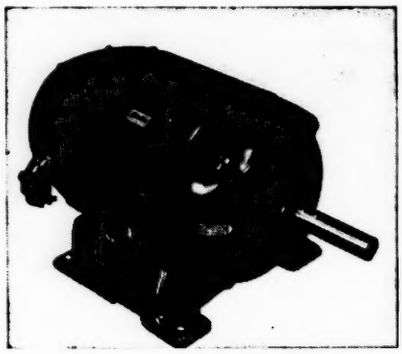
NAME—McQuay non-ferrous extended surface cooling coils.
PURPOSE—Heat transfer.
FEATURES—Cooling coils are pro-



vided with ripple fins of continuous plate type aluminum. Ripples are parallel to the air flow and provide extra transfer surface. Ripples also stiffen the fins and provide protection against lateral deformation. Bonding of fins to tubes is accomplished by hydraulic expansion of the tubes until contact is made with every part of every fin collar. Eliptube headers have intruded tube holes. Headers are elliptical to create greater flexibility, thereby reducing coil core strains during start-ups. Standard fin spacing is 8 per in. although other spacings can be furnished for special requirements. Nineteen standard nominal tube lengths are available.
LITERATURE AVAILABLE — Catalog No. 400.
MADE BY—*McQuay, Inc., 1600 Broadway, N.E., Minneapolis 13, Minn.* **227**

Motor

NAME—Westinghouse wound-rotor life-line induction motor.
PURPOSE—For operating adjustable speed fan drives and for similar applications.
FEATURES—Motors may be used wherever adjustable speed is required or where high-starting torque with low-starting current is necessary. Rotor core consists of punchings riveted into a solid structure and held on the shaft by a shrink fit. Rotor windings have coils threaded into partially enclosed slots. An oversize fan gives maximum air circulation. Ball bearings have a special lubricant sealed-in at the factory and makers believe that under normal conditions, further lubrication will not be required for five years or longer. Brushes are made of electro-graphite or metal graphite depending on requirements.
SIZES AND CAPACITIES—60, 50 and 25 cycle, two- and three-phase, 208, 220, 440 and 550 volts; at speeds of 1,750, 1,160, 870, 690, 580 rpm for 60 cycle; 1,450, 965, 715, 580, 485 rpm for 50 cycle; and



1,450, 750, and 485 rpm for 25 cycle.
MADE BY—*Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.* **228**

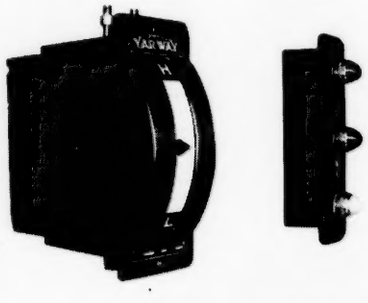
Circulator

NAME—Circyulator.
PURPOSE—Circulation of water in forced hot water heating systems.
FEATURES—Motor has a safety thermal cut-off and bronze bearing. On the stainless steel shaft, made in one complete assembly, are brass disc, bronze impeller, brass lock nut, graphite washers, neoprene ring, tension spring and washer. Spring mounting of motor is used for cutting down noise and vibration. Rotary type water seal is used to eliminate stuffing boxes and packing rings. Unit has a cast iron body and is powered by a 115 volt, 60-cycle motor, 1/8 or 1/6 hp.

SIZES AND CAPACITIES — Made in four sizes with capacities of 27, 36, 47 and 73 gpm.
MADE BY — *Yula Water Heaters, Inc., 166 W. 225 St., New York 63, N. Y.* **229**

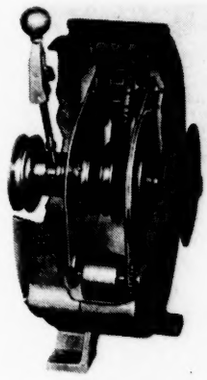
High-Low Signal

NAME—Attachment for Yarnall-Waring remote liquid level indicator.
PURPOSE—For operation of one or more distantly located electric type visible or audible high-low alarm signals and or controllers for pump motors.
FEATURES—Control consists of two-pole curved-bar permanent magnet fixed to shaft of indicator pointer and actuating one or the other of two sealed-in glass mercury switches which, in turn, operate the signals installed at remote locations where check on the liquid level may be required. The visible signal shows red light at top or bottom for high level or low level condition corresponding to high-low position of indicator pointer. Center lens shows green or amber during normal level range of indicator. Audible high-low signal uses two vibrating horns of different tones or a single horn for both high and low levels.
LITERATURE AVAILABLE — Bulletin WG-1822.
MADE BY—*Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa.* **230**



Speed Selector

NAME—Goodrich speed selector.
PURPOSE—Speed ratio changes for stepless speed control.
FEATURES—Two V-belts and four variable pitch sheaves provide any speed change up to 800 rpm at constant torque. A slight change in the variable pitch in the sheaves results in a large change in output speed. Adjustable limit stops restrict the speed range as desired. A sideward motion of the handle locks the control in any desired position. Ball bearings are sealed to exclude dirt and moisture.



SIZES AND CAPACITIES—Available in ½-, 1- and 2-hp models.
MADE BY—*The B. F. Goodrich Co., Akron, Ohio.* **231**

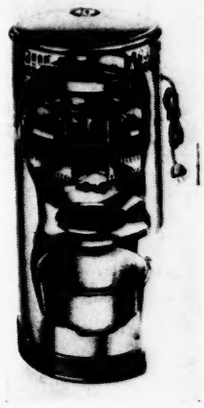
CO_2 Indicator

NAME—Dwyer carbon dioxide indicator.
PURPOSE—For testing efficiency of oil burners, furnaces, and other heating plants.
FEATURES—Indicator is constructed of transparent plastic with metal parts of stainless steel. Indicator has a 4-in. scale calibrated to 1/5 of 1% CO_2. Accuracy is said to be ½ of 1% CO_2.
OPERATION—Scale is set to zero and a gas sample pumped from the installation into the device with 15 strokes of the aspirator bulb. The instrument is shaken briefly and the CO_2 percentage is read from the fluid level on the scale. Solution can be used for about 1,000 tests.

LITERATURE AVAILABLE — Bulletin No. 220.
MADE BY—*F. W. Dwyer Manufacturing Co., 317 So. Western Ave., Chicago 12, Ill.* **232**

Dehumidifier

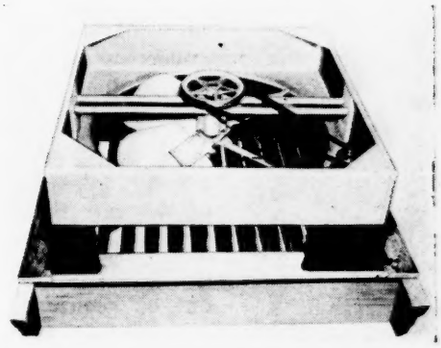
NAME—Frigidaire dehumidifier.
PURPOSE—To remove excess moisture from air.
FEATURES—Unit employs a refrigeration cycle to cool a series of coils to less than room temperature. Air drawn in by a fan passes over these coils, is cooled and the moisture is condensed on the coils. Moisture drops into a 2½-gal. receiver. The suction fan has two 10-inch blades. The sealed-in refrigeration system has a ⅛-hp Meter-Miser.



SIZES AND CAPACITIES — Height, 33⅝ in., diameter, 14 in. Weight, 85 lb.
MADE BY—*Frigidaire Div., General Motors Corporation, Dayton 1, Ohio.* **233**

Attic Fan

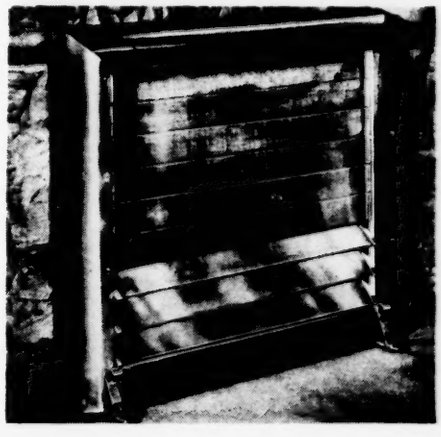
NAME—Rancher fan, model R-303.
PURPOSE—Package type attic fan for ranch-type homes or dwellings with low pitched roofs.
FEATURES — Packaged unit has a sheet metal plenum, air-tight cushion seal, and sealed bearings for all moving parts. The four-bladed fan is mounted horizontally with vertical air flow and belt drive. Blades are 30 in. long and fan is powered by a 1/3-hp motor.
INSTALLATION—Proper sized hole is cut in floor and fan is mounted in horizontal position above opening with the automatic shutter below. Plenum is fastened to the floor with wood screws and fan rests in the plenum on a felt cushioning strip. Shutter opens automatically when fan is turned on and closes when turned off.



SIZES AND CAPACITIES—Unit is rated to deliver 6,900 cfm.
MADE BY—*The Lau Blower Co., Dayton 7, Ohio.* **234**

Fireplace Screen

NAME—Dollinger fireplace control screen.
PURPOSE—To prevent flying sparks from reaching room interior.
FEATURES—Unit has heavy plate glass louvers which can be adjusted at top or bottom to check or increase draft to fireplace. Louvers are spaced ⅛ in. apart to provide the minimum amount of air. Louvers are operated by turning knurled knobs geared to the glass strips. A bronze mesh screen is placed back of the louvers.
SIZES AND CAPACITIES—Three standard sizes available.
MADE BY—*Dollinger Corporation, Rochester, N. Y.* **235**



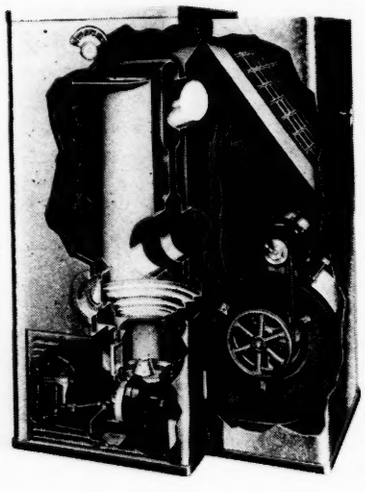
Dust Collector

NAME—Gem dust collector.
PURPOSE—For collecting dust from individual machines or from several concentrated dust points where no central dust collecting system is installed.

FEATURES — Units are portable and are self-contained. Should a change in production layout be required, unit can be easily moved as required. It may be provided with hopper bottom if desired with slide gate valve and supporting legs. Height of legs provide 12 in. clearance under dust collecting valve. Fans are direct connected to motor.
SIZES AND CAPACITIES—Four sizes to handle 550, 800, 1,000 and 1,350 cfm with fan operating at 6 in. static pressure.
MADE BY—*Parsons Engineering Corp., 2545 E. 79th St., Cleveland, Ohio.* **236**

Furnace

NAME—Superfex Model 84 oil-fired furnace.
PURPOSE — Space heating for the home.
FEATURES—Unit is equipped with a 3-stage burner which operates with a minimum chimney draft. Vital parts of the burner are made of stainless steel. A 3-stage thermostat regulates the 3-stage oil control and constant level valve. Other automatic controls include a combination limit switch and 2-speed blower control, 2-speed combustion-air blower with automatic damper, low voltage transformer, draft regulator and automatic drip humidifier. The blower is driven by a 2-speed motor. Blower cabinet, with throw-away type steel wool filters, may be mounted on either side of the furnace. Burner uses No. 1 grade fuel oil.



SIZES AND CAPACITIES—Output of 75,000 Btu at the bonnet. Makers recommend it for a 4 to 6-room insulated house.
MADE BY — *Perfection Stove Co., 7609 Platt Avenue, Cleveland 4, Ohio.* **237**

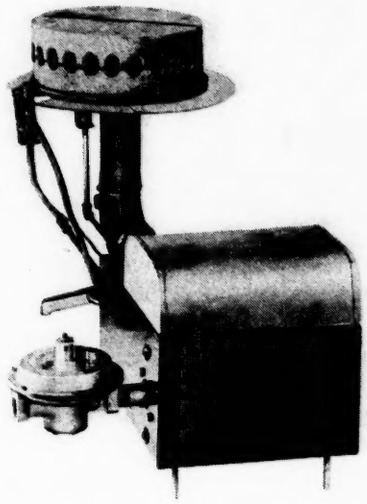
Dial Thermometer

NAME—Marsh dial thermometer.
PURPOSE — Temperature measurement.

FEATURES — Instrument measures 2-3/16 in. in diameter and is provided with an unbreakable crystal. Should unit ever be knocked out of adjustment a recalibrator slide on the back simplifies correction. All that is necessary is to set the slide to coincide with a thermometer reading of known accuracy. Instrument has a temperature range of —40 to 100F.
MADE BY—*James P. Marsh Corp., Dept. 58-P, Skokie, Ill.* **238**

Conversion Burner

NAME—Whirl-heat conversion gas burner.
PURPOSE—Burner for use with natural, manufactured, LP, and other gases.



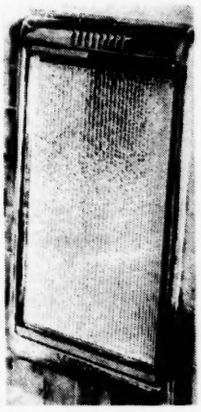
FEATURES—The burner head has 24-port refractories of horizontal design. The primary air injector type gas orifice is provided with interchangeable orifice spuds. Controls consist of a M-H motorized gas valve, M-H room acratherm, M-H airstat (for warm air systems), aquastat (hot water), and pressure regulator (steam). It has a spring actuated low-pressure regulator, safety pilot and escapement pilot.
MADE BY—*Kindl-Aire Corp., 1480 West 112th Street, Cleveland 2, Ohio.* **239**

Leak Sealer

NAME—Tub-Tite.
PURPOSE—Caulking compound for sealing air conditioned rooms.
FEATURES—Resin-based plastic caulking compound is applied directly from its tube and is then smoothed into place with an applicator. Compound dries within an hour to form a white, glossy surface that is said to be not affected by oil, grease, acid, alkali, or water. Compound is claimed to adhere to tile, glass, wood, metal, brick, and concrete.
MADE BY—*The American Fluresit Co., Cincinnati 29, Ohio.* **240**

Radiant Heat

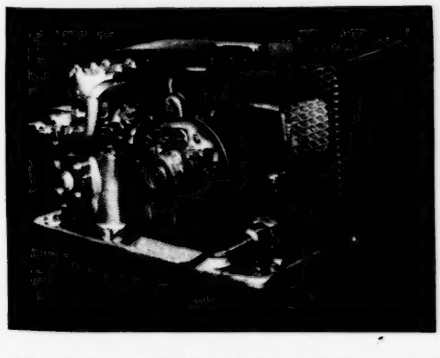
NAME—Radiant glass heat.
PURPOSE—Space heating by radiant heat.
FEATURES—Special panel of tempered glass has fused aluminum element that is connected to a source of electric power. An aluminum reflector is placed back of the panel in frame. A timing device cuts in the power 7 seconds out of every 30 seconds for room temperatures of 68F. Operates on either 110 or 220 volt a-c or d-c current. Wattage is cut 25% when surface temperature of glass plate reaches 300F.



SIZES AND CAPACITIES—Standard panel is 16 x 24 in. and operates on 1,000 watts. Two other sizes available of 0.5 and 1.5 size of standard panel. One panel is said to be sufficient for room of 1,400 cu ft or less.
LITERATURE AVAILABLE—Illustrated booklet.
MADE BY—*Continental Radiant Glass Heating Corp., 521 5th Ave., New York 17, N. Y.* **241**

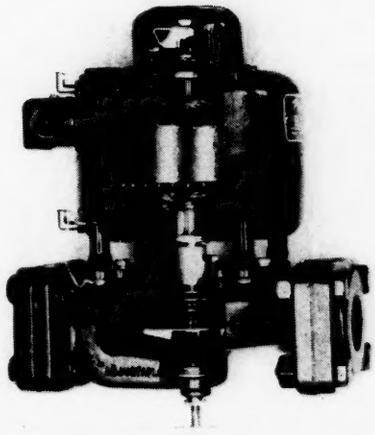
Dehumidifier

NAME—Carrier Humidry.
PURPOSE—For removing moisture from basement and other areas where dampness and humidity may exist to cause discomfort and deterioration.
FEATURES—Unit operates on a 1/3-hp motor and is said to be capable of removing 17 quarts of water a day from the atmosphere of a normal size room in a humid climate. Unit can be plugged into an ordinary electrical outlet, and a connection provided for running moisture down a drain.
MADE BY—*Carrier Corporation, Syracuse, N. Y.* **242**



Circulator

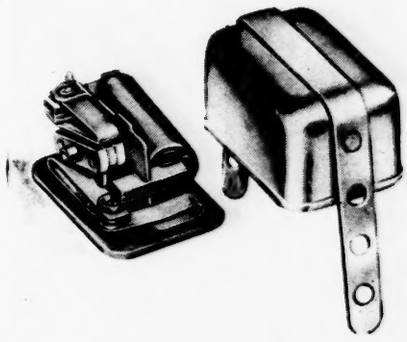
NAME—Pezzillo adjustaflo hot water circulator.
PURPOSE—To permit the circulation of a controlled volume of selected temperature water.
FEATURES — Circulator has sealed oilite motor bearings. Pump-shaft is permanently lubricated and sealed at the factory. The switch



is located outside of the motor housing and can be adjusted or replaced on the motor in a short time. Makers claim that the unit will permit any desired temperature drop and enable complete shut-off of heating system. Overload protector has an automatic reset.
MADE BY—*Pezzillo Pump Co., Inc., Philadelphia 32, Pa.* **243**

Motor Switch

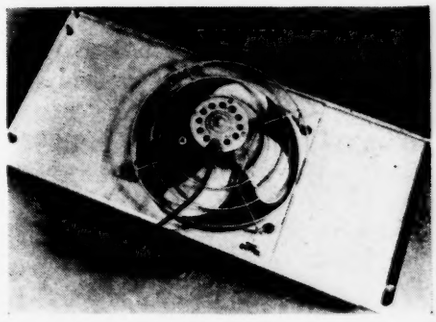
NAME—Fitch, Allen universal type motor starting switch.
PURPOSE—For operation of small motors.
FEATURES—Switch can be used to start single phase, split-phase, or capacitor start, 90 to 130 volt, 50 to 60 cycle motors ranging from 1/6 to 1/3 hp. Unit is provided with flexible slotted metal straps for quick mounting. Switch is connected in series with the working winding of the motor and responds to open the starter winding circuit



between 1,400 and 1,500 rpm as the current drops. If a predetermined rpm is desired it can be secured by adding an external resistance.
SIZES AND CAPACITIES—Switch measures 1 1/8 by 1 11/16 and is 1 in. high.
MADE BY—*Fitch, Allen & Co., 1131 Bryn Mawr Avenue, Chicago 40, Ill.* **244**

Window Fan

NAME—Thomson & Bishop exhaust fan for window mounting.
PURPOSE—For removing fumes or kitchen odors.
FEATURES—Sliding side panels may be adjusted to permit mounting in windows from 22 to 33 in. wide.



Fan has 10-in. blades which are operated at 1,500 rpm by a 110-volt, 60-cycle, a-c shaded pole induction motor. Unit moves 600 cfm.
MADE BY—*Thomson and Bishop, 910 Larch Avenue, Takoma Park, Md.* **245**

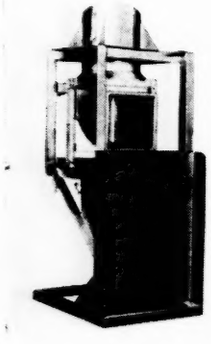
Velocity Meter

NAME—Airite grille velocity meter.
PURPOSE—For indicating air movement in an open space.
FEATURES—Unit is self-contained

and is provided with a detachable handle to facilitate use on low sidewall air registers. An 8-in. long scale is provided with scale divisions of 20 ft per min. By means of a lock, the scale reading can be retained until lock is released.
MADE BY—*Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh 8, Pa.* **246**

Fan

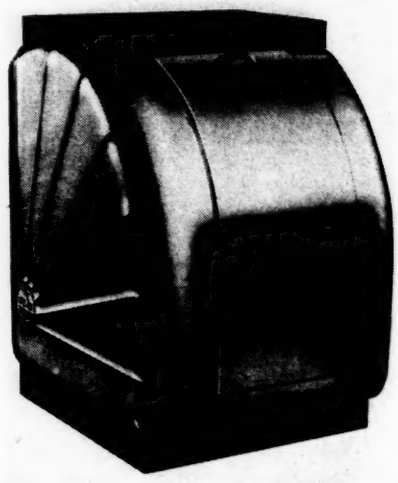
NAME—Pacific-Wing induced draft unit.
PURPOSE—To permit elimination or lowering of free-standing stacks.



FEATURES—Unit is said to provide positive draft with exact control and a minimum amount of stack. Electrically operated fan has manual speed control for proper regulation of draft. Unit is installed by bolting to boiler, either for right hand, left hand, or rear breeching connection to stack, or for top outlet with self-supported stack.
SIZES AND CAPACITIES—Five sizes adaptable to all commercial automatically fired boilers and having steam ratings from 2,680 to 42,500 sq ft.
MADE BY—*Pacific Steel Boiler Div., United States Radiator Corp., Detroit 31, Mich.* **247**

Blower

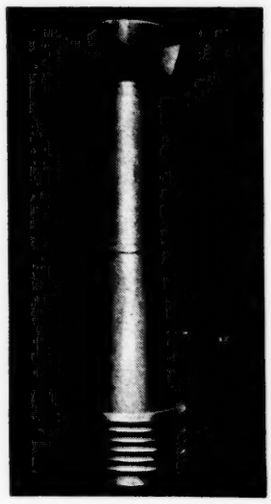
NAME—Viking blower package.
PURPOSE—Compact blower unit for furnaces.
FEATURES—Filters are arranged in a cabinet so that they may be removed through the rear door. Cool air may be drawn through the basement for summer circulation. Resilient cushioning is used in mounting the blower, bearings, and motor. Package comes completely assembled ready for installation.
SIZES AND CAPACITIES—Two sizes—small size has an 11-in. blower with a capacity of 1,000 cfm for



furnaces up to and including 24 in.; other size has a 13-in. blower and delivers 1,800 cfm and is suitable for furnaces up to and including 28 in.
MADE BY—*Viking Air Conditioning Corp., 5600 Walworth Ave., Cleveland 2, Ohio.* **248**

Unit Heater

NAME—Thermobloc.
PURPOSE—Unit heater for space heating.
FEATURES—Self-contained unit which requires a small amount of floor space, needs only connections to an oil or gas supply, and power connections. It can also be used for drying applications and for an air circulator during the summer. Oil or gas burners are interchangeable. The oil burner is of the pres-



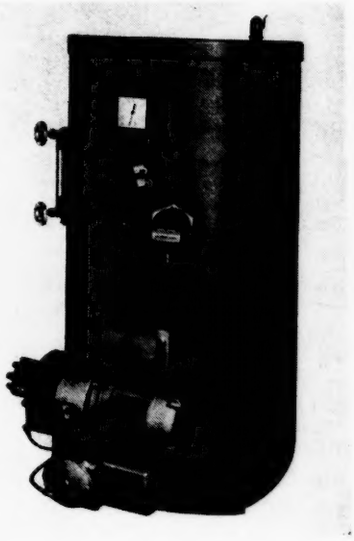
sure gun type which operates on No. 3 oil or lighter. Heat transfer is obtained by direct transfer of the product of combustion to air. Forced draft fan at the bottom of unit is axial flow type. Air is discharged laterally through four adjustable louvered nozzles.
SIZES AND CAPACITIES—Height, 10 ft; diameter, 30 in.; weight, 1,200 lb. Oil consumption 5 gph; blower capacity, 4,000 cfm; heat output, 550,000 Btu per hr.
MADE BY—*Thermobloc Division, Prat-Daniel Corp., East Port Chester, Conn.* **249**

Scale Solvent

NAME—Corodex coil clean.
PURPOSE—To remove the lime deposit from hot water and steam coils.
FEATURES—Liquid is brought in contact with the scale and a foaming action starts which continues until all the lime has been removed. Liquid is non-explosive and non-inflammable and is available in quantity from 1 to 55 gal. It is said to dissolve mineral deposits from copper, brass, bronze, iron or steel coils.
MADE BY—*Allied Products Co., Dept. C-47, 1133 Newport Ave., Chicago 13, Ill.* **250**

Boiler

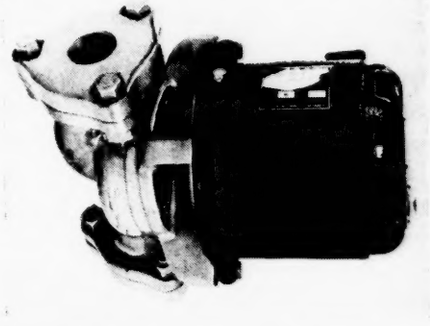
NAME — HomEase model R unit boiler.
PURPOSE—Space heating for small homes.



FEATURES — Units are fired by a HomEase oil burner. Light weight cast refractory brick combustion chamber is built into the unit. Controls are conveniently located and a built-in water heater provides winter-summer hot water.
SIZES AND CAPACITIES—Available in five sizes for 320, 400, 550, 700, and 900 sq ft of steam radiation.
MADE BY—*HomEase Products Co., 50 Iowa Avenue, Paterson 3, N. J.* **251**

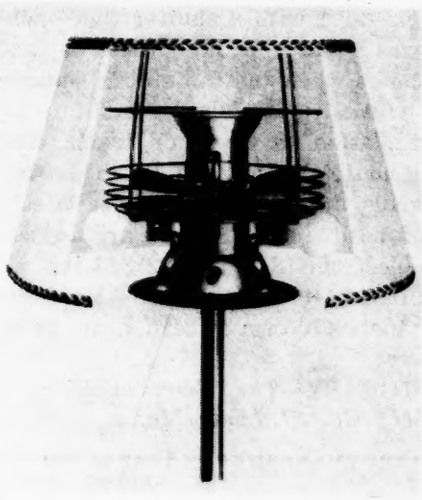
Circulator

NAME—Aqua-Matic.
PURPOSE—For general hot water circulating pump use.
FEATURES—Unit can be installed on the left or right side of a pipe line and on horizontal or vertical pipe lines as long as the motor is in a horizontal position. Motor has quiet sleeve type bearings and a mounted wiring junction box for simplicity in wiring. A stainless steel tension spring is provided to take up possible bearing wear.
SIZES AND CAPACITIES—Flow varies from 30 gpm for 1-in. pipe to 80 gpm for 2-in. pipe.
MADE BY—*Louis Engineering Co., 214 W. Ontario Street, Chicago 10, Ill.* **252**



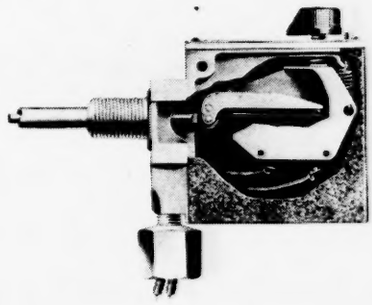
Fan

NAME—Walton Fanlamp.
PURPOSE—Installation of fan in floor lamp to provide air movement in room.
FEATURES—Fan brings up air from floor at a rate of 500 cfm and discharges it at the top of the lampshade which acts as a funnel. Fan has a speed regulator which changes the air movement from 200 to 500 cfm. Fan is enclosed in a wire guard and the motor is a 30 watt, G.E. unit operating at 60 cycle a-c, 110 to 120 volts. Lamp is designed for direct or indirect lighting.
MADE BY—*Abbeon Supply Co., 58-10 41st Drive, Woodside, N. Y.*...**253**



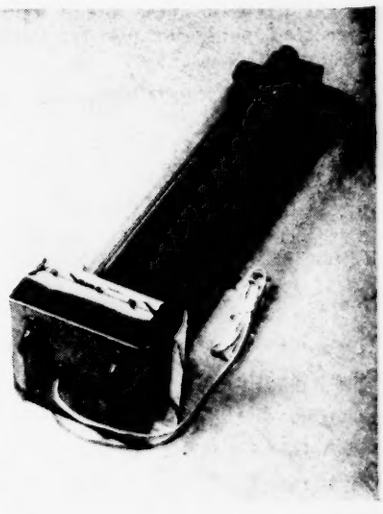
Thermostat

NAME—Blondee model K-1.
PURPOSE — Watertight thermostat for use in processing work where a close differential is essential and where there is excessive moisture or dust.
FEATURES—Metal case is soldered to the cast iron body and the lead wires are sealed with a special cement to make a completely vapor, moisture and dust-proof control. It is constructed to withstand temperatures outside of its calibrated range from sub-zero to 300F. Electric contacts are snap action and have a capacity of 10 amps, 125 volts; 5 amps, 250 volts, a-c. The outlet is standard ½ in. pipe thread.
MADE BY—*Alloy Bellows Engineering Co., 935 Grayton Rd., Cleveland 12, Ohio.* **254**



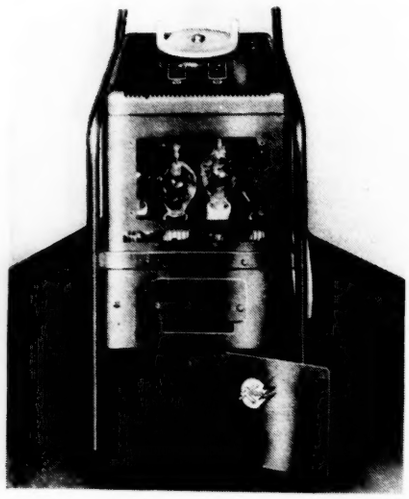
Sterilizer

NAME—Sterilator.
PURPOSE—For destroying bacteria in warm air ducts.
FEATURES—Unit is equipped with a G-E 4000-hr life germicidal lamp for installation in the ducts of a warm air heating system. Makers claim that the average four or five-room home requires no more than a two 15-watt unit only 19 in. long.
MADE BY—*Sterilator Div., Coleman-Pettersen Corp., 2130 St. Clair Ave., Cleveland 14, Ohio.* **255**



Welder

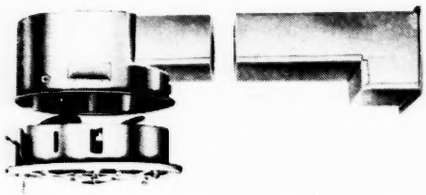
NAME—Kern duel-tronic combination d-c, a-c welder.
PURPOSE—General welding use.
FEATURES—For d-c operation, unit



uses rectifier tubes installed in a flexible mounting. Makers claim that the instant arc response eliminates surging and electrode spatter. The a-c welding characteristics are said to include smooth, instant starting and stable arc action as well as quiet operation. Makers claim metal as light as 32 gage can be welded without burning through. A hand wheel, mounted on top of the welder, provides stepless amperage settings for a-c or d-c operation. Arc is set for a-c or d-c operation by setting two switches and a hand lever.
SIZES AND CAPACITIES — Model 20 DA, d-c range 5 to 60 amps, a-c range 25 to 200 amps. Model 25 DA, d-c range 5 to 90 amps, a-c range 25 to 200 amps.
MADE BY—*John A. Kern Co., 224 N. Loomis St., Chicago 7, Ill.* **256**

Kitchen Ventilator

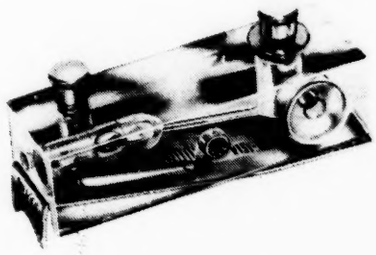
NAME—Emerson Junior built-in kitchen ventilator.
PURPOSE—Kitchen ventilator for ceiling mounting.
FEATURES—Unit consists of three sections—ceiling grille and fan unit, ceiling housing and outside grille. The ceiling grille and fan unit in one section may be placed in the ceiling housing after walls are plastered. Ceiling housing is



provided with a shutter that opens when the fan is turned on and closes when the fan stops. Outside grille is rectangular to facilitate installation in brick or frame construction. Angle baffles in outside grille are said to minimize effects of headwinds. Sleeves are adjustable from 18 3/4 to 22 3/4 in.
SIZES AND CAPACITIES—Fan exhausts 470 cfm at zero static pressure.
MADE BY—*The Emerson Electric Mfg. Co., St. Louis, Mo.* **257**

Draft Gage

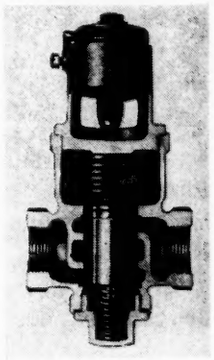
NAME — Dwyer transparent visi-draft gage.
PURPOSE—Instrument for setting draft controls.



FEATURES — Instrument permits quick leveling and indicates 1 deg. out of level for each 0.1 in. bubble movement. Unit is made from a solid block of clear plastic and the scale is graduated in .01 in. divisions.
MADE BY—*F. W. Dwyer Manufacturing Co., 317 So. Western Ave., Chicago 12, Ill.* **258**

Tempering Valve

NAME—Safetymix.
PURPOSE—Tempering valve to provide constant temperature water.
FEATURES—



The bellows which actuates the unit is mounted out of water in a protected chamber which is open to the atmosphere. This unit is interchangeable and can easily be removed. Temperature setting is made on a dial calibrated in 10-deg units. Valve is said to compensate for normal pressure fluctuations.
SIZES AND CAPACITIES—Available in 3/4 and 1 in. size. The former can deliver 20 gpm at 50 lb per sq in. and the 1-in. size, 35 gpm at 50 lb per sq in.
MADE BY—*Symmons Engineering Co., Boston, Mass.* **259**

AUGUST, 1948

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

219	220	221	222	223	224	225
226	227	228	229	230	231	232
233	234	235	236	237	238	239
240	241	242	243	244	245	246
247	248	249	250	251	252	253
254	255	256	257	258	259	

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Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

ELEMENTARY STEAM POWER ENGINEERING

Practical applications and concise presentations of fundamental principles underlying the construction and operation of steam power plants and equipment are embodied in the third edition of Elementary Steam Power Engineering by Edgar MacNaughton, Professor of Mechanical Engineering, Tufts College Engineering School.

While intended for men of college grade, the mathematical discussion was made sufficiently simple to make the text suitable for the general reader. Practical applications are presented before the theory is discussed.

The edition has a complete revision of the material on steam turbines and includes a discussion on mercury vapor and regenerative cycles; material on the heat transfer in feed water heaters and condensers. The book has been reset, obsolete material has been removed, and new material and illustrations have been added. Material in the third edition is divided into 28 chapters.

Besides his activity as a teacher, Prof. MacNaughton has been active in consulting work in the power field for many years.

Elementary Steam Power Engineering, by Edgar MacNaughton. Cloth bound, 6 x 9 in., 640 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price, $6.50.

ABBREVIATIONS, SIGNS AND SYMBOLS

Perhaps the most complete assembly of "scientific and technical abbreviations, signs and symbols" are contained in the book by that name compiled by O. T. Zimmerman, Professor of Chemical Engineering, University of New Hampshire, and Irvin Lavine, formerly Professor of Chemical Engineering, University of North Dakota.

The coverage is most complete and includes, engineering, military, medicine, commerce and astronomy. The material is divided into 17 sections as follows: General list of abbreviations, mathematics, and statistics; chemistry, chemical engineering, thermodynamics, heat flow, humidity, and radiation; mechanics, magnetics, hydraulics, acoustics, and illumination; mechanical drawings, material of construction, and shop terms; electricity and electronics; mapping; railways; aeronautics and aviation; communications; meteorology; military; medicine, botany, and zoology; commerce; astronomy; Latin expressions, states, punctuation and proof reading; technical journals.

Scientific and Technical Abbreviations, Signs and Symbols, by O. T. Zimmerman and Irvin Lavine. Cloth bound 5½ x 8¼ in., 476 pages. Published by Industrial Research Service, Dover, N. H. Price, $7.50.

• • •

BUSINESS DEALINGS WITH THE ARCHITECT AND CONTRACTOR—This is the twentieth in a series of circulars issued by the Small Homes Council on various phases of home planning and construction. This circular starts with getting plans and guides the prospective builder through to final termination of the contract. It cautions that since each step in building is an important transaction involving large sums of money, to build without professional advice and written agreements is foolhardy. For a free copy write to the Small Homes Council, University of Illinois, Urbana, Ill.

COPPER TUBE FOR REFRIGERATION SERVICE — The National Bureau of Standards has distributed a proposed commercial standard for refrigeration service copper tube. Developed in cooperation with the Copper & Brass Research Association it provides minimum requirements for eight standard sizes (⅛ to ¾ in. dia) of seamless annealed copper tube for refrigeration service. For a mimeographed copy write to the Commodity Standards Division, National Bureau of Standards.

REVISED MINERAL WOOL STANDARDS—The Commodity Standards Division of the National Bureau of Standards, has mailed copies of revised standards, CS 105-43 to manufacturers for approval. This covers mineral wool in loose, granulated or felted form in low temperature installations. Requirements for moisture sorption, corrosive properties, odor, fire resistance, cold asphalt mastic, asphalt emulsion and re-enforcing membraces are included. Commodity Standards Division, National Bureau of Standards, Washington 25, D. C.

DUST—George H. Gill in his Dust and its Effects on the Respiratory System has reviewed the wide range of literature dealing with this subject—the medical science regarding the human system, physical laws concerning the properties of particles and their distribution in the air, and chemical data. All of this information has been arranged to provide a book that is easy to read and understand. The effects of various types of dust in the lungs are based mainly on the published reports of the Medical Research Council, translated into simple language. Paper bound, 50 pages, price 5 shillings. Published by H. K. Lewis & Co., Ltd., 136 Gower St., London, W.C.1., England.

DEGREE-DAYS FOR JUNE, 1948

HEATING AND VENTILATING'S 21st Year of Publication of Monthly Degree-Day Data

City	June			Cumulative, Sept. 1 to June 30			Heating Season[1]
	1948	1947	Normal	1947-48	1946-47	Normal	Normal
Abilene, Texas	0	0	0	2853	2838	2061	2061
Albany, New York	75	81	0	7473	6710	6580	6580
Albuquerque, New Mexico	3	9	0	4604	4298	4298	4298
Alpena, Michigan	127	206	138	8011	8055	8265	8299*
Anaconda, Montana	230	383	251	8489	8440	8261	8357**
Asheville, North Carolina	5	18	0	3908	4093	4232	4232
Atlanta, Georgia	0	7	0	2830	2880	2890	2890
Atlantic City, New Jersey	27	46	0	5092	4565	5176	5176
Augusta, Georgia	0	1	0	2289	2192	2161	2161
Baker, Oregon	121	267	213	6855	6880	7163	7163
Baltimore, Maryland	0	5	0	4469	4076	4533	4533
Billings, Montana	96	187	60	7090	7498	7119	7119
Binghamton, New York	0	68	0	6700	6220	6808	6808
Birmingham, Alabama	0	1	0	2765	2784	2352	2352
Bismarck, North Dakota	96	118	45	9341	9047	9192	9192
Block Island, Rhode Island	136	158	99	6091	5427	5788	5788
Boise, Idaho	44	127	0	6010	5906	5552	5552
Boston, Massachusetts	113	86	0	6275	5495	6045	6045
Bozeman, Montana	181	311	230	8218	8016	8425	8521**
Buffalo, New York	71	76	12	6768	6527	6822	6822
Burlington, Vermont	114	121	3	8184	7491	7514	7514
Butte, Montana	189	372	236	8881	8846	8162	8235**
Cairo, Illinois	0	0	0	3945	3783	3909	3909
Canton, New York	122	108	0	8270	7822	8020	8020
Charles City, Iowa	28	0	0	7414	7332	7588	7588
Charleston, South Carolina	0	0	0	1944	1724	1769	1769
Charlotte, North Carolina	0	0	0	3711	3028	3120	3120
Chattanooga, Tennessee	0	2	0	3239	3435	3118	3118
Cheyenne, Wyoming	154	264	126	7519	7731	7466	7466
Chicago, Illinois	61	121	59	6154	6113	6077	6077
Cincinnati, Ohio	1	5	0	4571	4472	4684	4684
Cleveland, Ohio	40	66	0	6090	5919	6155	6155
Columbia, Missouri	0	9	0	4830	4895	4922	4922
Columbia, South Carolina	0	1	0	2495	2297	2364	2364
Columbus, Ohio	3	23	0	5291	5243	5398	5398
Concord, New Hampshire	157	144	54	8031	7324	7353	7353
Concordia, Kansas	3	37	0	5516	5569	5315	5315
Dallas, Texas	0	0	0	2693	2476	2256	2256
Davenport, Iowa	7	58	0	6172	6097	6289	6289
Dayton, Ohio	12	41	0	5799	5709	5264	5264
Deer Lodge, Montana	190	244	235	8196	7827	8582	8672**
Denver, Colorado	57	130	0	5828	5991	5874	5874
Des Moines, Iowa	6	61	0	6288	6412	6384	6384
Detroit, Michigan	52	87	0	6554	6367	6490	6490
Devils Lake, North Dakota	112	166	96	10,257	10,006	9970	9970
Dodge City, Kansas	7	32	0	5402	5304	5035	5035
Dubuque, Iowa	29	83	0	6706	6711	6790	6790
Duluth, Minnesota	191	301	216	9503	9591	9483	9483
Eastport, Maine	341	333	300	8373	7630	8241	8520**
Elkins, West Virginia	49	78	0	5633	5796	5697	5697
El Paso, Texas	0	0	0	2908	2708	2428	2428
Ely, Nevada	227	275	(a)	7971	7632	(a)	(a)
Erie, Pennsylvania	54	73	0	6120	5918	6273	6273
Escanaba, Michigan	161	227	138	8558	8529	8746	8771
Evansville, Indiana	0	5	0	4739	4667	4244	4244
Fort Smith, Arkansas	0	0	0	3437	3336	3147	3147
Fort Wayne, Indiana	20	77	0	6388	6316	5925	5925
Fort Worth, Texas	0	0	0	2720	2532	2148	2148
Fresno, California	0	0	0	2611	2552	2334	2334
Galveston, Texas	0	0	0	1445	1407	1016	1016
Grand Junction, Colorado	30	73	0	6019	5727	5548	5548
Grand Rapids, Michigan	45	93	0	6512	6460	6535	5635
Green Bay, Wisconsin	79	160	0	8003	7904	7825	7825
Greensboro, North Carolina	2	2	0	3841	3760	3529	3529
Greenville, South Carolina	0	6	0	3166	3081	3380	3380
Harrisburg, Pennsylvania	10	21	0	5500	5118	5375	5375
Hartford, Connecticut	57	72	0	6635	5881	6036	6036
Hatteras, North Carolina	1	0	0	2422	2252	2571	2571
Havre, Montana	112	146	144	7910	8747	8700	8700
Helena, Montana	153	272	171	8015	8159	7834	7894**
Houston, Texas	0	0	0	1557	1489	1157	1157
Huron, South Dakota	61	81	0	8228	8026	8004	8004
Indianapolis, Indiana	4	30	0	5310	5202	5298	5298
Jackson, Mississippi	0	0	(a)	2296	2233	(a)	(a)
Kansas City, Missouri	0	11	0	4962	4880	4956	4956
Knoxville, Tennessee	0	3	0	3442	3658	3670	3670
La Crosse, Wisconsin	38	100	0	7866	7748	7322	7322
Lander, Wyoming	106	283	135	7783	8065	7947	7947
Lansing, Michigan	84	120	0	7096	6901	7048	7048

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

Degree-Days for June, 1948 (Concluded)

HEATING AND VENTILATING's 21st Year of Publication of Monthly Degree-Day Data

City	June			Cumulative, Sept. 1 to June 30			Heating Season[1]
	1948	1947	Normal	1947-48	1946-47	Normal	Normal
Lewiston, Maine	138	163	45	7848	7511	7707	7707
Lincoln, Nebraska	2	43	0	6019	5898	5999	5999
Little Rock, Arkansas	0	0	0	3223	3102	2811	2811
Livingston, Montana	149	293	142	7489	7782	7185	7245**
Los Angeles, California	17	5	0	1548	1340	1504	1504
Louisville, Kentucky	0	3	0	4351	4280	4180	4180
Lynchburg, Virginia	3	13	0	4262	4171	3980	3980
Macon, Georgia	0	1	0	2337	2287	2201	2201
Madison, Wisconsin	51	121	0	7483	7270	7429	7429
Marquette, Michigan	220	296	186	8512	8665	8650	8693*
Memphis, Tennessee	0	0	0	3371	3152	2950	2950
Meridian, Mississippi	0	0	0	2336	2347	2160	2160
Milwaukee, Wisconsin	88	189	39	7241	7359	7245	7245
Minneapolis, Minnesota	24	98	0	8032	7986	7850	7850
Modena, Utah	111	133	42	7098	6295	6562	6562
Montgomery, Alabama	0	0	0	2017	1963	1884	1884
Nantucket, Massachusetts	212	207	123	6397	5730	5957	5957
Nashville, Tennessee	0	3	0	3664	3658	3507	3507
New Haven, Connecticut	64	91	0	6402	5731	5895	5895
New Orleans, Louisiana	0	0	0	1402	1219	1024	1024
New York, New York	16	34	30	5373	4867	5274	5274***
Nome, Alaska†	1013	807	973	13,095	13,079	13,658	14,580**
Norfolk, Virginia	6	4	0	3338	3073	3350	3350
North Head, Washington	226	235	309	4865	4743	5002	5452**
North Platte, Nebraska	36	84	0	6169	6434	6366	6366
Oakland, California	120	61	93	3276	2938	2963	3143**
Oklahoma City, Oklahoma	0	3	0	3821	3604	3613	3613
Omaha, Nebraska	3	45	0	6220	6187	6131	6131
Oswego, New York	129	145	63	7105	6673	7088	7088
Parkersburg, West Virginia	8	14	0	4756	4667	4775	4775
Peoria, Illinois	0	48	0	6012	6069	6109	6109
Philadelphia, Pennsylvania	3	15	17	4916	4420	4737	4737***
Phoenix, Arizona	0	0	0	1651	1278	1405	1405
Pittsburgh, Pennsylvania	11	36	0	5461	5389	5235	5235
Pocatello, Idaho	73	187	60	7007	6757	6655	6655
Portland, Maine	184	189	81	7856	7318	7218	7218
Portland, Oregon	49	96	90	4191	3923	4469	4469
Providence, Rhode Island	65	72	0	5966	5304	6015	6015
Pueblo, Colorado	22	67	0	6047	5939	5514	5514
Raleigh, North Carolina	0	0	0	3363	3104	3234	3234
Rapid City, South Dakota	114	194	30	7215	7805	7118	7118
Reading, Pennsylvania	8	20	0	5296	4881	5389	5389
Red Bluff, California	14	6	(a)	3093	2563	(a)	(a)
Reno, Nevada	127	156	90	6328	5681	5892	5892
Richmond, Virginia	1	4	0	3920	3619	3695	3695
Rochester, New York	75	80	0	6933	6530	6732	6732
Roseburg, Oregon	55	133	114	4410	4229	4428	4428
Roswell, New Mexico	0	0	0	3951	3479	3484	3484
Sacramento, California	17	6	0	2993	2683	2653	2653
St. Joseph, Missouri	2	15	0	5471	5272	5161	5161
St. Louis, Missouri	0	6	0	4622	4507	4585	4585
Salt Lake City, Utah	43	96	0	6022	5852	5555	5555
San Antonio, Texas	0	0	0	1859	1844	1202	1202
San Diego, California	26	0	6	1637	1340	1645	1645
Sandusky, Ohio	28	67	0	6000	5773	6208	6208
San Francisco, California	175	116	195	2922	2748	2876	3264**
Sault Ste. Marie, Michigan	223	269	189	9111	9212	9139	9285**
Savannah, Georgia	0	0	0	1729	1585	1490	1490
Scranton, Pennsylvania	47	50	0	6309	5856	6129	6129
Seattle, Washington	84	109	162	4562	5207	4857	4934**
Sheridan, Wyoming	101	220	120	7508	7863	8008	8008
Shreveport, Louisiana	0	0	0	2454	2272	1938	1938
Sioux City, Iowa	22	71	0	6927	7198	6898	6898
Spokane, Washington	66	129	81	6809	6358	6355	6355
Springfield, Illinois	0	17	0	5162	5230	5373	5373
Springfield, Missouri	0	12	0	4684	4694	4428	4428
Syracuse, New York	66	83	12	7108	6581	6893	6893
Tacoma, Washington	104	144	183	4951	4738	5066	5181**
Terre Haute, Indiana	1	26	0	5460	5156	4872	4872
Toledo, Ohio	34	78	0	6494	6282	6077	6077
Topeka, Kansas	2	14	0	5060	4997	4997	4969
Trenton, New Jersey	8	30	0	5341	4808	4933	4933
Utica, New York	66	85	0	7285	6088	6796	6796
Valentine, Nebraska	61	109	0	7052	7378	7039	7039
Walla Walla, Washington	12	41	0	4982	4623	4808	4808
Washington, D. C.	0	2	0	4368	4038	4626	4626
Wichita, Kansas	1	13	0	4765	4740	4673	4673
Williston, North Dakota	(a)	162	54	(a)	9346	9323	9323
Winnemucca, Nevada	73	141	117	6394	5931	6391	6427**
Yakima, Washington	19	70	0	5840	5541	5599	5599

(a) Data not available.
†Nome data are for May.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

NEWS OF THE MONTH

DUCTED HEATERS

convert direct-fired floor units to makeup air distributing system in factory with heavy spray booth exhaust.

The problem of winter ventilation of a factory structure, in which spray painting and other fume-producing operations are a part of production, is solved uniquely at the Homestead Valve Manufacturing Co., Coraopolis, Pa. Company engineers and the consulting architects, Prack and Prack, of Pittsburgh, have incorporated two large Dravo Counterflo direct-fired heaters with a capacity of 2 million Btu per hr each in a design to bring in, warm, and distribute approximately 44,000 cfm of makeup air. Thus, a uniform temperature of 70F is maintained in the working area despite removal of large volumes of fume-laden air.

• **PLANT.**—The plant is 400 ft long and 100 ft wide, with all floor area being unobstructed except for partitioned offices, storage rooms and lavatories. It contains approximately 750,000 cu ft. The welding shop, where steam coils are fabricated, is separated from the rest of the plant by a partial wall 10 ft high. Ceiling height ranges from 18 ft at sidewalls to 25 ft in the center bay.

Each of three paint spray booths—one used infrequently for small parts—removes 18,000 cfm. The second principal loss of air from the building is in the testing and inspection bay where finished products, high pressure steam cleaning units, are operated for one hour. Twelve exhaust ducts drop down from the roof to within a few inches of the top of each of 12 units being tested simultaneously. Combustion fumes are carried off in the ducts by natural draft.

• **SYSTEM.**—The two makeup air heaters are positioned along opposite sidewalls about 100 ft apart. Outside air is drawn in through louvered wall openings behind each heater. The air intake of each is approximately 22,000 cfm through filters. In the heater, the air flows first over banks of economizer tubes leading from the combustion chamber to the vent stack. Then it sweeps the combustion chamber and is discharged into an overhead duct.

In foreground, one of the make-up air heaters in the Homestead Valve Mfg. Co. plant.

From one heater, a sheet metal duct 90 in. x 18 in. runs 48 ft toward the center of the building near the inspection and testing bay. Air discharges from the duct horizontally at right angles through two 90 in. x 16 in. grille openings, one facing the paint spray area and the other the test area. Velocity of discharge is about 2000 fpm. The duct on the second heater is of the same cross section but only 20 ft long. It is flared at the end to 135 in. wide.

The burner of each heater is controlled by a separate thermostat set at 70F. In winter an interlock connection between heater and spray booth switches prevents the spray booth from operating unless the heater is turned on. When the heaters are started initially, they operate for a short time on air recirculated from inside the plant. An automatic damper in the louvered opening of the heater's base closes when the air temperature satisfies the ductstat. This is to prevent cold outside air from being discharged into the plant. J. W. Force, chief engineer of the new plant, explained that the unit warms up in less than one minute from a cold start, thereby providing fresh heated air quickly.

• **SPACE HEATING.**—Ordinary space heating requirements in the plant are taken care of by seven 400,000-Btu and one 750,000-Btu Dravo heaters operating on the air recirculation principle. Three of the heaters have ducts connected to their discharge nozzles to carry warm air to the offices, lavatories and storage rooms.

SECOND GASIFICATION TEST

launched by signing of contract for further underground coal burning experiment in Alabama.

Approval of a contract between the Bureau of Mines and Alabama Power Company for a second and larger cooperative experiment in underground coal gasification at Gorgas, Ala., was announced June 22 by James Boyd, Director of the Bureau.

The initial joint experiment last summer showed that gases produced by burning unmined coal offer a potential source of fuel for power and raw materials for synthetic liquid fuels. If proven feasible, underground gasification offers alluring possibilities for minimizing expensive mining and for utilizing coal veins difficult or uneconomic to mine.

• **COST.**—Cost of the large-scale field test, including Bureau expenditures and those of the company which are reimbursable, is estimated at $411,000 for a one-year period. Under the contract, the company will provide engineering and operating services on an actual cost basis (without profit), and will contribute

SOIL PIPE AVAILABLE

LARGE SIZES OF
REVERE COPPER WATER TUBE
for soil, waste and vent lines

● You can get all the soil pipe you need *right now!* Your Revere Distributor can make prompt delivery of Revere Copper Water Tube in the sizes required for soil, waste and vent lines in home or commercial construction.

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1. *It is highly resistant to corrosion, which assures a longer life for the system.*
2. *Its permanently smooth interior surfaces provide free, unobstructed flow.*
3. *Joints made with solder fittings are economical in time and materials.*

In drainage systems—just as in heating, water supply and air conditioning—*trouble always costs more than Revere Copper Water Tube.* Each length of this tube is stamped at regular intervals with the Revere name and the type. These marks are more than identification—they are your assurance of full wall thickness and the close gauge tolerances so essential for tight soldered joints.

You can specify or install, in addition to Revere Copper Water Tube, such other long-lived materials as Red-Brass Pipe; Sheet Copper and Herculoy for tanks, ducts, pans and trays; Dryseal Copper and Aluminum Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes. The Revere Technical Advisory Service is always ready to serve you. Call your Revere Distributor.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

as a site for the experiment some 300 acres of Pratt seam coal averaging 40 inches in thickness.

• **PROGRAM.**—Preliminary core drilling already is in progress to determine the composition of the ground overlying the coal, which ranges from 60 to 125 ft in depth. The next phases of the site-preparation job to be undertaken will be the drilling of five large-diameter holes to the coal bed and the driving of two parallel entries, 1,200 ft from the coal outcrop into the bed and a single butt entry for an additional 300 ft. Equipment will be installed simultaneously.

Director Boyd estimated that the site-preparation work would be completed next fall. At that time, he added, interested persons will be invited to inspect the underground workings before the coal bed is fired for the first experimental run.

• **OBJECTIVES.**—Objectives of the experiment are:

(1) To determine the quantity of coal which can be gasified from a given combustion zone and the shape and extent of the burned-out area formed.

(2) To determine whether fixed outlets for gas produced are practicable, either at the outcrop of the coal bed or at vertical bore holes. Various designs of inlets, outlets, and seals will be tested.

(3) To determine the operating characteristics of the installation under a variety of conditions.

(4) To determine the quality and quantity of product gas generated with an air blast under experimental conditions and, secondly, the quantity of tar and related products obtained.

(5) To obtain information on the effect of heat on the overlying strata.

(6) To obtain fundamental technical and economic information concerning plant sites, installations, and operating processes.

• **FIRST TRY.**—Last year's experiment produced encouraging results, Boyd said. It was shown that combustion could be maintained and controlled, that coal in place could be gasified completely, and that the roof rock would become plastic, expand, and settle down behind the burning coal face without cutting off the air or gas. The gas obtained, however, was of lower heating value than desired. This was attributed to leakage of gas and air pressure through cracks and breaks in the thin (30 foot) cover over the burning coal seam.

• **QUALITY.**—To correct this fault, the new experiment will be carried out at a much deeper level—100 ft or more—and with much heavier air pressures and higher temperatures. These factors are expected to increase the average heat value of the gas produced with an air blast from 47 Btu per cu ft obtained last year to from 70 to 125 Btu. Oxygen and steam can improve the gas quality further, as was shown in the first field trial when runs made with an oxygen-enriched air blast, an oxygen-air-steam blast, and an oxygen-steam blast increased the average heating value of the gas produced to 50, 110, and 134 Btu per cu ft, respectively.

• **USES.**—Although of lower heating value than normal commercial gas, the product was burned successfully under a boiler. If available in quantity, it could be used to make electric power and perhaps for other industrial heating fuel requirements. If heating values can be improved materially, underground gasification offers a cheap source of synthesis gas—carbon monoxide and hydrogen—the No. 1 problem in making synthetic liquid fuels manufacture economic.

HEATING WHOLESALERS

hear business and technical speakers at mid-year convention.

The mid-year convention of the National Heating Wholesalers Association, held at the Edgewater Beach Hotel, Chicago, featured progress reports covering growth of the new organization and a series of talks pointing out present and future business activities of interest to the group.

President A. H. Johnson of Pittsburgh reported that the Association has gained 26 new member firms since its last meeting in December. Mr. Johnson also reported successful operation of the Association's system of inventory interchange which was established as a means of balancing distribution. Headquarters of the Association were recently moved to 239 Water Street, Pittsburgh.

• **SPEAKERS.**—Dr. Lawrence E. Miller of Michigan State College spoke on "Engineering Service Education from Wholesaler to Dealer." Dr. Miller pointed out that the increasing complexity of modern equipment requires increasingly high levels of technical skill on the part of personnel installing and maintaining such equipment. The burden of educating installation and maintenance personnel falls logically, says Dr. Miller, upon the wholesaler distributor.

D. D. Couch, American Radiator and Standard Sanitary Corp., urged members to improve sales technique and redouble sales efforts against the day when the sellers' market turns to a buyers' market. Other speakers on the program included Owen Anderson of Marsh & McLennan, insurance brokers; Edwin B. Moran, National Association of Credit Men; W. L. McGrath, The Williamson Heater Co.; J. E. Eckstein, attorney; John W. Boatwright, Standard Oil Co. of Indiana; H. J. Ruttenberg, Portsmouth Steel Corp.

• **STEEL SUPPLY.**—Delegates conducted an informal round-table discussion with Mathias Niewenhouse, Chief, Building Materials Negotiation Division, Office of Industrial Cooperation, U. S. Department of Commerce. Mr. Niewenhouse discussed the operation of his agency and informed the wholesalers that the attorney general and the secretary of commerce had approved the allocation of 233,000 tons of steel products during the next eight months for the production of heating equipment to 450 capable manufacturers of warm air furnaces including jackets and casings, flue connected floor and wall furnaces, radiators and grilles, furnace blowers, furnace pipe, and prefabricated fittings and duct work.

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. . . . . puts an end to makeshift spring mountings

The new Honeywell Spring Return Motor — a complete, self-contained unit with added power.

HERE'S good news! Honeywell has developed a self contained spring return mechanism for its power failure motors. You mount it anywhere—no spring brackets to run up installation costs.

In the event of power failure, this new motor automatically positions the damper either full open or full shut. And with a 160 degree stroke, it offers 2½ times more power than previous models, which were limited to a 60 degree stroke because of the external spring construction. This means only one motor is needed for even larger dampers than before. It also means improved control for unit ventilators where the motor must perform several functions in sequence.

So remember, Honeywell's new spring return motor brings you two important advantages. First, you benefit through simplified installation at lower cost. Secondly, you get more power—2½ times more. And, always, there is positive protection in the event of power failure. Get all the details at once. Just address a card to Minneapolis-Honeywell, Minneapolis 8, Minn. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS Honeywell CONTROL SYSTEMS

73 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

NEW EVAPORATION PROCESS

uses refrigeration for heating and cooling simultaneously in citrus juice canning plant.

In February the Florida Citrus Canners Cooperative started at Lake Wales a plant for concentrating fruit juices, working on a new principle which uses a refrigerating machine instead of a boiler to heat the citrus juice and drive off excess water. The same refrigerating machine simultaneously cools and condenses the water vapor under vacuum.

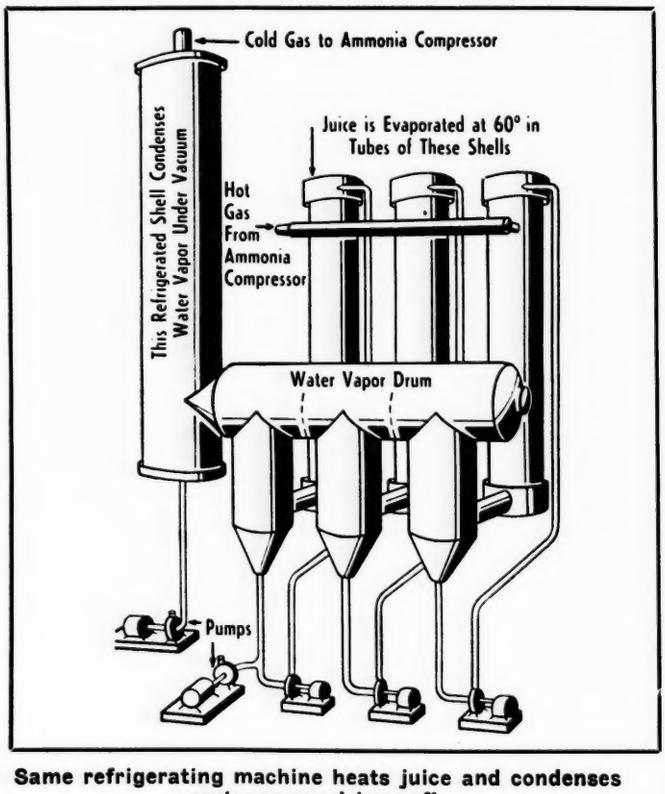
The heat balance in this closed cycle uses only 70 gallons of water per minute to carry away extra heat, through a small supplementary condenser.

• **QUICK PROCESS.**—Juice from oranges, lemons, limes, or grapefruit is evaporated so quickly and at such a low temperature that the flavor is not modified and the food and vitamin values are preserved. Fresh juice and pulp are added to the concentrate to reinforce the flavor; the product is passed through continuous freezers, sealed in cans under vacuum, hardened, and sold in frozen condition. The consumer adds three cans of water to one can of the frozen juice. Most people cannot tell the prepared juice from that of freshly harvested fruit.

• **HEAT BALANCE.**—For a century, designers have been searching for a method of concentrating liquids in a closed vacuum cycle, the heat given off in the condenser to be used in boiling the incoming liquid. There is less than 2% more heat in a pound of steam at 100F than at 60F. But at the condensing temperature of 60F, the volume of each pound of the vapor is 1208 cu ft. Any vapor pump handling such a volume in a commercial plant would lose far more than 2% in friction; other charges combine to make it cheaper to use live steam than the regenerative cycle.

However, the high coefficient of performance of a refrigerating system, from the standpoint of heat, adapts it perfectly to this service. A refrigerating machine can deliver from 3 to 5 times the heat-energy put into the motor driving it. Applied to shell-and-tube vessels for evaporating and condensing water from orange juice, this means 2 lb of ammonia gas with a total volume of 7.2 cu ft are pumped instead of a pound of water vapor at 1208 cu ft.

• **THE PROCESS.**—As shown in the diagram, there are three vertical evaporating shells, which contain tubes of stainless steel. The heads and covers of the shells are also of stainless steel, as is the flash drum into which they drain. The three shells are heated by the discharge gas, at 105F, from a 4-cylinder Frick ammonia compressor of 11 in. bore and 10 in. stroke. After flowing by gravity through the tubes of the first shell, the juice runs into a catch basin below the flash drum. Water vapor is released, while the liquid drops to a pump and is recirculated through the shell. In this first loop the juice remains 1.3 minutes; beginning with 8 to 13% of soluble solids, it is concentrated to about 20%. As more juice is fed in, it overflows a partition in the flash drum and enters the second-stage evaporator, where in another 1.3 minutes the concentration is raised to 40%. By the time the juice leaves the third evaporator, the soluble solids content is approximately 60% and the temperature of the juice, depending on the rate of feeding and the vacuum maintained, is between 50 and 70F.

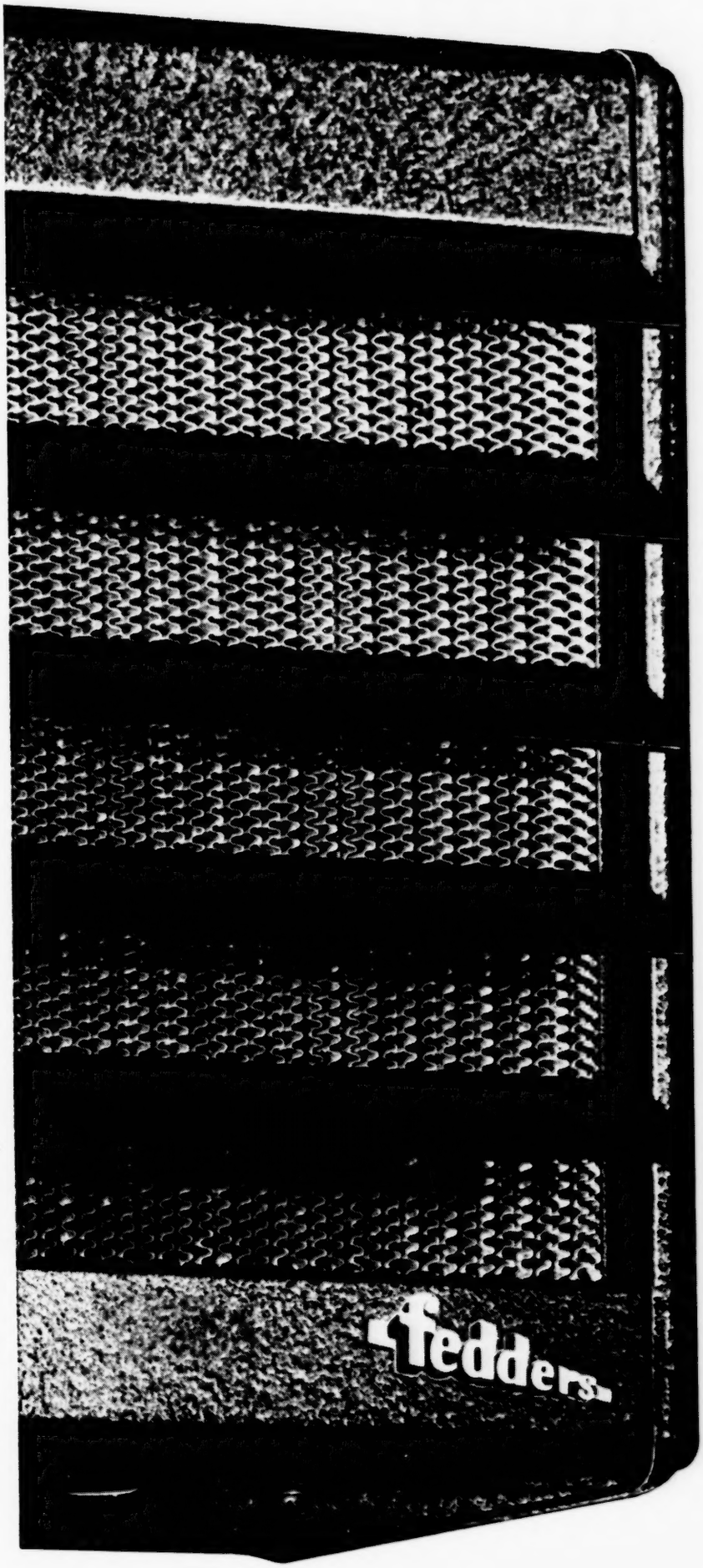

Cold Gas to Ammonia Compressor
This Refrigerated Shell Condenses Water Vapor Under Vacuum
Juice is Evaporated at 60° in Tubes of These Shells
Hot Gas From Ammonia Compressor
Water Vapor Drum
Pumps

Same refrigerating machine heats juice and condenses water vapor driven off.

The water vapor evaporated from the juice passes from the flash drum into the bottom of the condenser shell. Here ammonia, expanded at 45F, is in the tubes. A two-stage steam ejector, connected near the top of the shell, maintains a vacuum equivalent to 0.35 or 0.40 in. of mercury. Condensate amounting to 4050 lb per hr is removed by a Westco pump, Series C, with ¾-hp motor. The suction gas passes through a surge drum or accumulator, into which the liquid ammonia is also fed by electric and float control valves. The main ammonia suction goes direct to the same 4-cylinder compressor which discharges into the three evaporators at 105F.

Part of the discharge gas is reduced to a liquid in the three shells, and the cooling is completed in a small horizontal shell-and-tube condenser, mounted above the ammonia receiver. The 70 gpm of water enter this condenser at 80F and go out at 98F.

Concentrated juice is pumped from the evaporator into an ammonia jacketed mixing tank held under vacuum; in this, enough fresh juice containing pulp is added to adjust the soluble solids to 42%. As the tank fills, the temperature is lowered to about 25F. The juice is next run through a Votator, similar to a continuous ice cream freezer, made by the Girdler Corp. This freezes 35% of the water in the product to give a creamy slush at 16F. The semi-frozen juice



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is sealed under vacuum in cans. Trays loaded with the cans are conveyed to the hardenng coils in a —10F room, where they are exposed for 24 hours. They are later quickly packed in shipping cases in a room which is at ordinary temperature, before being returned to the storage room, maintained at —10F by two Frick air units of size No. 15,003. The equipment now in use produces 900 gal of final product in a little less than seven hours.

The cost of power per unit of evaporation with the ammonia system is considerably less than the cost of fuel used by the same cooperative for a double-effect steam evaporator system in another plant. The freezing and low-temperature storage work are handled by four other Frick compressors: a 15 by 10 duplex-coupled to a 9 by 9, a 6 by 6, and a 5 by 5. These machines each have two cylinders.

The process is equally applicable to concentrating milk, tomato juice, many additional kinds of fruit juices, pharmaceuticals, liquid eggs, pectin solutions, sucrose juices, chemicals, etc. The evaporation temperature can be anywhere between 40 and 160F. Little, if any cooling water is necessary. The condensate is recovered, hence the cycle can be used for distillation as well as evaporation.

CATHODIC PROTECTION

of underground metallic structures proves effective in six-year tests completed at the National Bureau of Standards.

A study of some of the factors involved in electrical protection against underground corrosion has been made by I. A. Denison and Melvin Romanoff of the National Bureau of Standards. In six out of eight test sites, corrosion of steel specimens was adequately prevented, over test periods ranging from 3 to 6 years, by connecting zinc cylinders to the steel.

• **CAUSE.**—Corrosion in soil is most often caused by difference in electrical potential between local areas on the corroded surfaces. It was found that those areas (anodic areas) where potentials are low with respect to adjacent surfaces are not subject to corrosion. If sufficient current is caused to flow from an external source toward the corroding surface, the potential difference between the local anodic and cathodic areas and consequently, the cause of corrosion is eliminated.

• **MEANS.**—If electric power is available, a cathodic protection unit can be economically installed with an outside source of current. Over long distances, such as those traversed by pipe lines, the cost of installing an outside source of cathodic current protection would be prohibitive. Fortunately, a source of energy for cathodic protection in such cases can be provided by the galvanic corrosion of bars of the electronegative metals, zinc, magnesium, or aluminum, buried at suitable intervals along the right of way and connected to the pipe line.

• **TEST.**—In order to investigate the behavior of zinc anodes for cathodic protection in various types of soils, the Bureau in 1941 initiated a series of field tests, in cooperation with pipe line companies, in which experimental zinc-steel couples were installed at eight test sites. The cathode of the experimental couple was a small steel ring, to which were connected either one, two, or three cylindrical zinc anodes, giving ratios of the area of steel to zinc of 20, 10, and 6.7, respectively. By varying these ratios, the current density on the corresponding cathodes was subject to some control. Unconnected steel rings and zinc cylinders were also buried at each test site.

• **RESULTS.**—After periods of operation ranging from 3 to 6 years, the units were removed from the test sites, and the extent of cathodic protection provided was determined. In six of the eight soils in which the couples were installed, satisfactory protection was obtained. Although a zinc-steel area of 1:20 was sufficient for protection at three of these sites, an area ratio of 1:10 was required at the other three. At the other two sites, high resistivity and high alkalinity of the soil tended to reduce the current output of the zinc anodes to such an extent that cathodic protection was not obtained. However, it is probable that both of these unfavorable conditions could be counteracted by surrounding the zinc anodes with a salt, such as calcium sulfate, which would not only increase the conductivity of the soil but would also prevent the formation of insoluble films or deposits of corrosion products on the zinc surface.

• **EXHIBIT.**—In connection with comparative field tests of the corrosion resistance of various pipe materials in different types of soils, the National Bureau of Standards has announced an exhibit of approximately 3,000 actual test specimens. Chemists, metallurgists, corrosion engineers, and others interested in the behavior of materials underground are invited to inspect the test samples, which will be on display until August 15, 1948, in the Bureau's Underground Corrosion Laboratory.

The specimens were exposed at 15 test sites throughout the United States for periods ranging from 5 to 14 years. They consist of 85 varieties of materials, including 7 types of wrought iron and wrought alloys; 17 types of cast iron and cast alloys; 22 types of steel and steel alloys; 13 types of copper and copper alloys; and miscellaneous samples of lead, zinc, metallic-and non-metallic-coated pipe, and asbestos-cement pipe. Measurements of loss of weight and depth of pitting of the specimens have been made, and a report on the corrosion resistance shown by the materials studied is in preparation.

CONSTRUCTION VOLUME

for first half of 1948 breaks 1947 record by $2 billion in spite of slight lag in private industrial building.

Paced by a gain of 60% in expenditures for new housing, the total volume of new construction in the

Workmen installing high-speed printing presses in the air-conditioned press rooms of The New York Times building. All of the ductwork in this building was handled by the Carroll Sheet Metal Company.

Headlines are printed faster in conditioned air

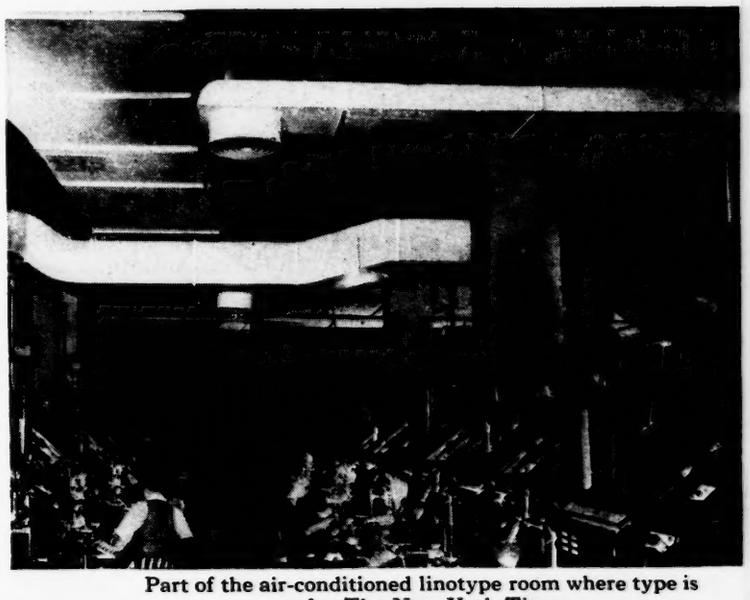
Air-conditioning is doing two important things for modern newspapers. It is saving valuable minutes in each press run. It is improving the quality of printing.

When left to nature, the changes in temperature and humidity of the air cause the pulp paper to expand or shrink and become saggy or brittle. This in turn frequently causes the continuous web of paper to break and foul up the high-speed printing presses. It also prevents ink from drying properly, and may result in smudging or smearing.

Control of the water vapor and temperature of the air gives the paper an even running tension. Presses can be held at constant speeds with less chance for paper breakage. Ink will absorb properly and dry quickly to produce flawless impressions.

The New York Times is using air-conditioning throughout its new building to gain these advantages. The up-to-the-minute system uses high-grade ductwork made of Beth-Cu-Loy Galvanized Steel Sheets. Here, as in many other important industrial air-conditioning installations, Beth-Cu-Loy was the choice, because these sheets resist corrosion better than ordinary galvanized steel sheets. Ducts made from Beth-Cu-Loy can be expected to give more years of uninterrupted service.

Beth-Cu-Loy has an open-hearth steel base containing 0.20 to 0.30 pct copper with a uniform, bright-spangled coating of Prime Western zinc. It is simple to form, to seam and to solder. Workmanlike jobs are easy to turn out with Beth-Cu-Loy.



Part of the air-conditioned linotype room where type is set for The New York Times.

An air-conditioned composing room. Overhead ducts are made from Beth-Cu-Loy Sheets.

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On the Pacific Coast Bethlehem products are sold by
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BETHLEHEM STEEL

first half of 1948 reached $7.7 billion, an increase of more than $2 billion over the same period of last year, according to the Construction Industry Information Committee.

• **RECORDS.**—The 449,700 new housing units started during the six months broke all records for an initial half year, the Committee said. The total was nearly 27% greater than the number of housing starts reported during the first half of 1947.

Expenditures for all new building, as estimated by the Bureau of Labor Statistics and the U. S. Department of Commerce, were 35% greater than in the first half of 1947 and were the largest for any corresponding period on record.

• **INDUSTRIAL.**—Gains were made in every type of private construction, except industrial building, which dropped 19%. However, the volume of other non-residential private building, including stores, warehouses, office buildings, garages, and churches, was 50% higher than in the first six months of last year.

• **OTHER.**—Expenditures for new farm construction increased 25%; public utility, 34%; publicly financed hospitals and institutions, 109%; and public educational buildings, 93%.

The volume of new highway construction was 31% higher, and expenditures for sewer and water facilities increased 43%.

Military and naval construction declined about 5% in volume, having been affected only slightly if at all by the revived armament program up to the middle of the year.

• **PAST YEAR.**—The building industry has constructed more than 250,000 new non-residential buildings, in addition to starting nearly 900,000 dwelling units of all kinds during the last year, according to an analysis prepared by economists of the Construction Industry Information Committee. Included in the total are 3,000 churches; 2,800 schools and libraries; 43,000 stores and warehouses; 13,600 factories and workshops; and more than 3,200 office buildings.

THREE WARM AIR SYSTEMS

in a single room give homeowner preference data in season of tests.

In order to relieve the congestion in their crowded household, the Levy family decided to convert an attached garage into a downstairs bedroom. This opened the way for a series of interesting experiments in modern heating. Marion I. Levy, Cleveland, president of Viking Air Conditioning Corp., had been reading a great deal about panel heating, and, he determined to take this opportunity to observe its operation first hand.

• **THREE SYSTEMS.**—The architect, Milo Holdstein, was instructed to install a panel heating system in the new bedroom; using a forced warm air ceiling panel of the latest design. But, in order to insure peace in the family, just in case the books might be wrong, he was also asked to arrange for a conventional forced air circulating system using high side-wall registers and base board returns. And just to add a further twist to the experiment, Mr. Levy figured that maybe a system combining panel heating with air circulation might possess the finer features of both methods of heating. As he explained it, panel heating may provide a comfortable temperature, but it cannot give the stimulating effect of proper air circulation, nor provide for continuous air filtration and humidification. So they worked out an ingenious, though simple, means of circulating the warm air through the ceiling panel; then, after losing its heat, it was blown out into the room, through a high side-wall register. The return air was drawn back to the furnace through a crawl space beneath the floor.

• **RESULTS.**—During the first winter the three systems were tried out successively. First, the ceiling panel was closed off, and the room was heated by high side-wall registers. By way of contrast, the rest of the house has low side-wall registers. The results were quite satisfactory, as might have been expected.

After a sufficient trial by the first heating method, Mr. Levy shut off the registers (both supply and return) and directed the air through the 2½-in. air space between the ceilings. Baffles guided the air as it passed through this space. The air returned through a duct in the outside wall into the crawl space beneath the floor. At first, they ran into trouble, since it required a higher static pressure to force the air through the narrow ceiling panel space than it did through ducts and registers in the rest of the house. An auxiliary blower took care of that matter in short order, and the test was on. Again the results were good. The room was comfortable and the floors warm.

• **THE WINNER.**—Finally system number three was put into service. The ceiling panel was used as before, but the outside wall duct was blocked and the panel air, after it had lost its heat in the ceiling panel, was blown into the room through a high side-wall diffusing register. That this system works very satisfactorily is attested to by the fact that it is still being used this way.

ULTRASONICS

puts high-powered sound generators to work at inaudibly high frequencies to clear smoke, precipitate dust, dry paper, etc.

High-power sound waves, some so shrill you can't hear them, have provided a new kind of tool for industry. Powerful sound waves are expected to precipitate smoke, speed paper-making by 20%, and eventually shatter airport fog from the air. Young scientists of Ultrasonic Corp. are building machines to generate high-power, high-intensity sound waves that are invading industry. The field of extra-strong sound is getting a boost, too, from experimenters at Pennsylvania State College Acoustics Laboratory.

• **LOUD.**—With their powerful machines tucked safely inside sound-proof chambers, the company's scientists

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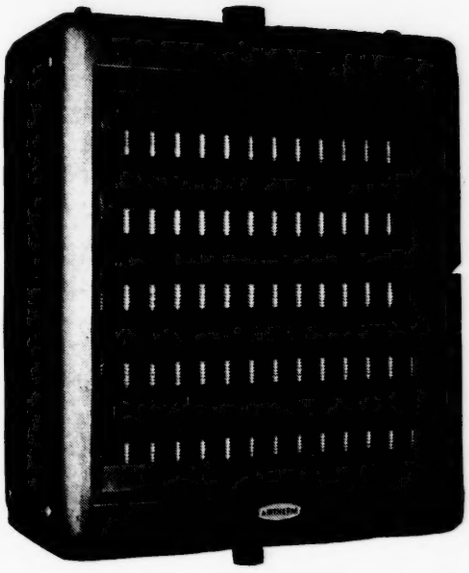
AIRTHERM
STEAM UNIT HEATERS
FOR OUTSTANDING PERFORMANCE



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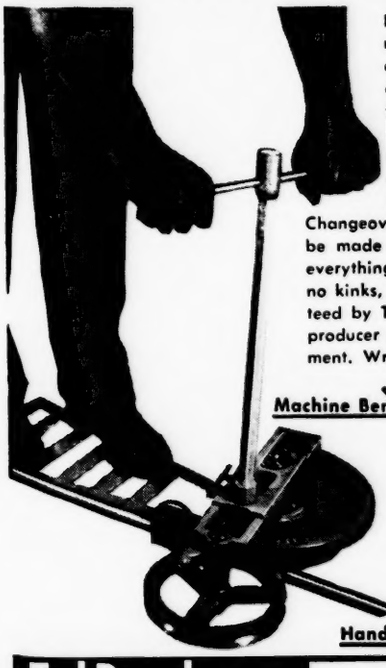
TAL Portable Tube Bender *for radiant heating*

Bend right on the spot, fast and accurately



Now, with this new light-weight machine that can be carried in one hand, you can speed-up radiant heating installations . . . for the Tal Tube Bender handles, without annealing, *hard copper* tubing as well as soft, both K and L, in all diameters from 3/8" to 1" in all standard radii. Changeovers from one size to another can be made in 40 seconds. One man does everything without help. No flattening, no kinks, no wrinkles. Made and guaranteed by Tal, the world's largest exclusive producer of pipe and tube bending equipment. Write today for data bulletin.

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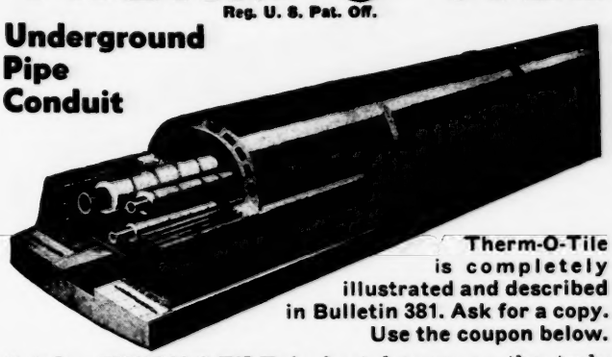

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Briefly, THERM-O-TILE is best known as the truly *permanent* underground pipe conduit. Much stronger than required by A.S.T.M. Dry insulation, always. No sagging. No condensation pockets. Highest efficiency. Lowest ultimate cost. Even the *first cost* is competitive.

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Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective underground pipe conduit job, on which we shall be glad to have your ☐ comments ☐ quotations.

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are rolling out sound waves 4,000 times as intense as a noise loud and powerful enough to hurt your ears. Some of these superwaves can be heard; others are pitched as high as 500,000 cycles a second, deep in the silent ultrasonic region.

• **SIREN.**—The machine that pounds out these waves is a highly refined version of a bicycle siren. Air is forced out through holes at the rim of a disk rotating hundreds of times a second. The air is cut by vanes in a stationary disk vaguely suggesting a turbine. Then the air pulses are passed through acoustic horns which focus and aim the sound waves.

With an air chopper like this, engineers can convert into sound waves 50% to 70% of the energy introduced as compressed air; an ordinary siren converts less than 1% of the energy.

• **USES.**—Armed with its powerful new generators, Ultrasonic Corp. is selling the use of sound waves to industry. So far their main job has been in chemical processes where the waves help recover some valuable products and purify others. One ultrasonic soundmaker is in operation, contracts have been signed for seven others and the firm is negotiating for the sale of 25 or so more, according to the *Wall Street Journal.*

First job of the powerful new waves—in this case the audible variety—has been to work on the tiny particles of solids or liquids which are suspended in gases and come rolling out of chemical vats and factory chimneys as fumes, mists or smoke.

A good example is the collector Ultrasonic installed in the new carbon black plant of Cabot Carbon Co. in Pampa, Texas. This manufacturing process, if you reduce it to simple terms, involves burning natural gas with so little oxygen that it forms a sooty smoke from which carbon black is separated. That's where sound waves come in handy.

A high-powered generator throws sound waves into a 20-foot-tall cylindrical drum containing the smoke. As the waves jiggle the tiny carbon particles thousands of times per second, the smaller, faster moving bits adhere to the larger, slower ones. These black particles "snowball" until they're large enough to fall to the bottom into a metal trap where they're drawn off.

Ultrasonic Corp. has a contract to put sound waves to work, similarly, collecting sulphuric acid fumes generated in a new sulphuric acid plant to be built in New Jersey by Chemical Construction Corp., a subsidiary of American Cyanamid Co.

Company officials claim their sonic apparatus will also recover fine dusts of lead, zinc, molybdenum and other metals that go up the stack in smelting processes; iron oxide and its fellow metals which end up in blast furnace fumes and fine dusts of chemicals, some worth $100 a ton.

The new sound machine is being installed in the plant of a big soap maker to help spray-dry soap. Powerful high-pitched sound waves will be aimed at the soap as it is sprayed out to dry. The sound vibrations will jiggle the droplets of soap so vigorously they'll zig-zag as they fall, covering 200 times the normal distance in the same amount of time. This violent motion means faster drying. It is claimed the same sound bouncing process can be used to spray-dry drugs, detergents, powdered milk or coffee.

Sound waves are going into paper making, too. In a plant of Southern Advance Bag & Paper Co. at Hodge, La., Ultrasonic is testing a sound-wave dryer.

CABIN COOLING

for jet aircraft and strato-liners advanced by compressed air expansion units.

Aircraft capable of flight speeds over 500 miles per hour require continuous and highly flexible cabin cooling to offset friction and other heat gains characteristic of high speed flight.

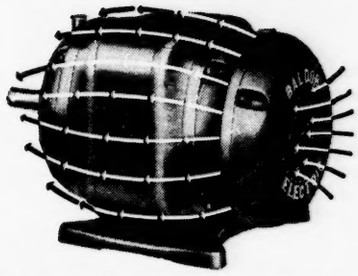
D. O. Moeller, chief engineer of the Stratos Corp., described cooling equipment for jet aircraft cabins in a paper presented at the spring meeting of The Society of Automotive Engineers. For airplanes using turbojet engines, said Mr. Moeller, air cycle refrigeration units are being used. One type of equipment is an expansion-turbine cooling system which bleeds air from the jet engine compressor. This air can be used for cabin ventilation, heating, cooling, and pressurization.

• **COOLING.** — The system uses two heat exchangers combined with a centrifugal compressor and an expansion turbine. Air from the jet turbine is passed through the first heat exchanger and then compressed in a centrifugal compressor.

Compressed air is cooled in a second heat exchanger and is finally cooled by expansion in the turbine and is ducted to the cabin. The power derived from the expansion turbine is used to drive the centrifugal compressor. The cooling medium for the heat exchangers is ram air.

• **HEATING.**—When heating is required, air from the jet compressor passes through a mixing valve and is by-passed around the cooling unit. The air introduced to the cabin from the jet engine compressor is also used to maintain cabin pressurization. For this reason the cooling unit is run at high capacity at low altitude, even when there is no cooling load and heating is required. This is because jet engine bleed air must be cooled and may not be simply throttled to accommodate variation in heating or cooling demand. Pressurization requirements dictate the minimum allowable cabin air flow. The air cycle unit uses the pressure drop available from engine bleed to accomplish cooling, so that the bleed pressure scheduled under various conditions of flight is the basic information from which the cooling performance can be derived.

• **MIXING VALVE.**—At intermediate conditions between full cooling and full heating, cabin temperature control is accomplished by proportioning by-passed hot air flow with the cooled flow from the cooling package. The mixing of engine bleed air is automatically con-



Arrows indicate forced air-movement over ENTIRE EXTERIOR of BALDOR STREAMCOOLED Motor.

Single Phase, ¾ to 7½ h. p.
3-Phase, 1 to 20 h. p.
Direct Current, 1 to 3 h. p.

uilds a Complete Line of Moto
G, VENTILATING and AIR CONDITIONING

These BALDOR Motors have won national acceptance because of their cool-running, quiet, efficient operation. Many manufacturers in your industry have consistently used them for more than 25 years.

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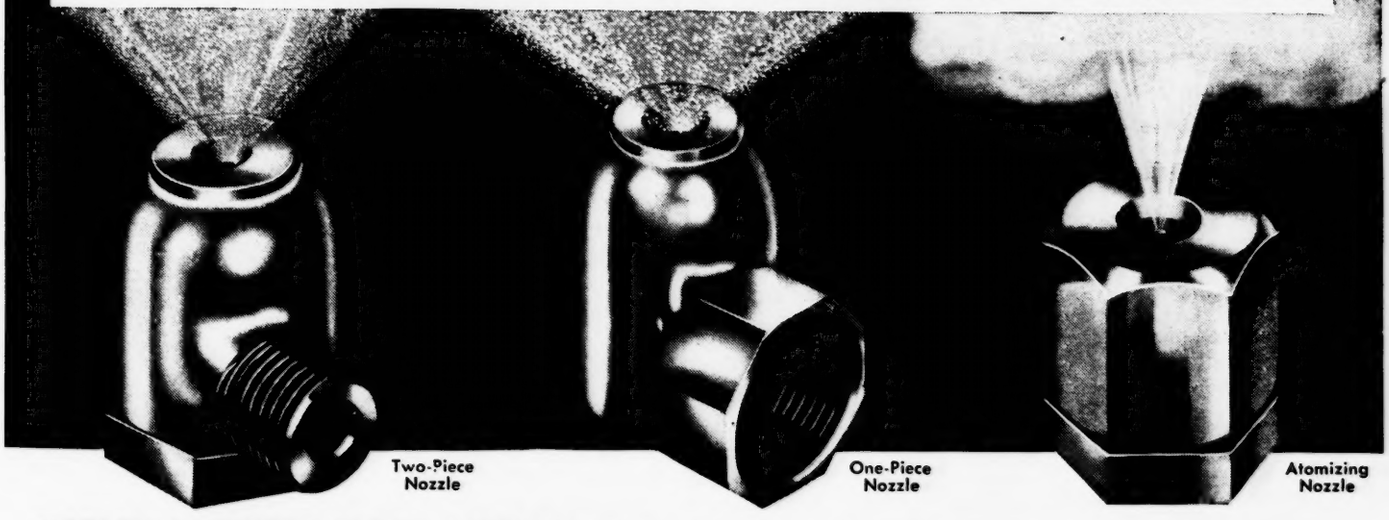
AND PRINCIPAL CITIES

BETTER MOTORS
FOR MORE THAN A QUARTER CENTURY

Greatest Distribution at Lowest Pressure



MARLEY PATENTED SPRAY NOZZLES deliver the ultimate in nozzle performance: *"Greatest distribution at lowest pressure."* The exclusive Marley design accomplishes top results with no moving parts. Offset venturi-type intake opening produces spiral action in the whirl chamber that results in a perfect cone of spray.

MARLEY NOZZLES are non-clogging in normal service. If clogging conditions exist, the **MARLEY TWO-PIECE NOZZLE** may be easily cleaned without removal from the line.

MARLEY ATOMIZING NOZZLES produce a mist-like spray with no large globules of liquid. It has achieved wide acceptance in process industries, for air washing, fruit and vegetable hydration, product mixing, DDT spraying.

Makers of the Complete Line of Marley Cooling Towers

The Marley Way Is the Perfect Spray

Ask for Marley Nozzle Bulletins

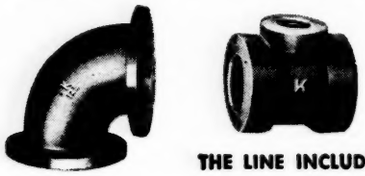
MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

You'll make your customers happy by supplying them with "K" fittings. The threads are straight, full, and perfect. They take hold easily because the chamfer in the opening guides the pipe thread in.

Yep! It's a pleasure to work with "K" fittings . . . a satisfaction, too, to be sure there won't be any leaks from bad joints or sand holes or cold checks.

"K" fittings are precision-cast, precision-machined, precision-inspected. Get 'em from your supplier.



THE LINE INCLUDES:

- Standard and Extra Heavy Cast-Iron Screwed Fittings
- Standard and Extra Heavy Companion Flanges
- Standard Flanged Cast Fittings
- Drainage Fittings

PRECISION FITTINGS

KUHNS BROTHERS CO.
DAYTON 1, OHIO

COMBINED SALES FACILITIES at Malleable Iron Fittings Company, Branford, Conn., and Kuhns Bros. Co., Dayton, Ohio.

trolled by a mixing valve, which is in turn controlled by a thermostat in the cabin.

The effect of humidity on the air cycle unit must be considered, because at low turbine discharge temperatures most of the moisture inherent in ambient air is condensed. When the cabin temperature is higher than the dewpoint, the condensed moisture reevaporates in the cabin and thus provides added cooling. When the cabin is maintained at ambient static temperature, no condensed water or fog remain in the cockpit. With low humidities, it is possible to produce turbine discharge temperatures, including the effects of moisture condensation, below 32F.

• **FUTURE.**—With extreme airplane speeds and increased engine bleed pressures, said Mr. Moeller, the use of existing type systems may become obsolete in that they are no longer capable of cooling the cabin at reasonable bleed flows. At other high speeds, the high temperature rise resulting from ram may require the use of a ram operated turbine.

A major problem confronting the designer of cooling systems for high speed aircraft is the temperature of the air in some sections of the rotating units. Air temperatures of 350 to 400F and even higher predominate and require special materials and lubricants.

• **LINER.**—An innovation for passenger comfort in large transport aircraft is an 80-lb cabin refrigeration system designed for the new Convair-Liner scheduled to go into service soon for American Air Lines. Developed and manufactured by the AiResearch Manufacturing Co. of Los Angeles, the unit is part of the cabin pressurization and air conditioning system. It delivers about 5 tons of refrigeration at capacity and consists of an air expansion turbine and two air-to-air heat exchangers, similar to the unit described by Mr. Moeller. The Convair-Liner unit fits into less than 6 cu ft of space and will drop the temperature of air supplied to the turbine from 200F to about 30F. The new system is capable of maintaining a cabin temperature of 75F under the continuously and rapidly changing conditions of flight.

NEWS BRIEFS

• Representatives of eight Spreader Stoker manufacturers and Bituminous Coal Research Inc. met to study means for improving the *utilization of bituminous coal.* A Spreader Stoker Research Committee was formed to administer the program. William S. Major, Development Engineer of Bituminous Coal Research, was elected chairman of the committee.

• The Veterans' Administration has now elected not to utilize the benefits of *modular construction* in veterans' hospitals being designed by its staff, according to David S. Miller, president of the Producers Council. The U. S. Corps of Engineers, however, advising architects in the design of such facilities, has urged the use of modular design, according to Mr. Miller.

P. P. & E. *Stainless* STEEL WELDING FITTINGS

For all Corrosion-Resisting Applications

Smooth, uninterrupted flow is assured in any piping system using P.P.&E. stainless steel welding fittings because:

(1) The interior walls of each fitting are free from scores, scratches, die marks, waves, or ridges.
(2) All elbows are "long radius"—$1\frac{1}{2}$ times nominal pipe size.
(3) All fittings perfectly match corresponding tubing and pipe sizes in circularity and in wall thickness.
(4) The ends are accurately machine tool cut—fittings of wall thickness over .083" are beveled to $37\frac{1}{2}°$ with approximately 1/16" straight face; those with wall thickness of .083" or lighter are cut straight, not beveled.

P.P.&E. fittings are available in Stainless Types 304, 316, and 347—to match pipe and tubing of various wall thicknesses in sizes from $\frac{3}{4}$" through 12".

The Most Complete Line of Stainless Steel Welding Fittings

STAINLESS ALLOY DIVISION
PITTSBURGH PIPING and EQUIPMENT COMPANY
10 43rd Street · Pittsburgh, Penna.
World's Largest Manufacturer of Stainless Steel Welding Fittings

Send for Catalog S-309

ANGLE RINGS

TO SPECIFICATION

Angle Rings are rolled in our plant every day by experienced, skilled workmen who have the knack of accurately turning out rings with uniform curvature. We can supply complete circles or any part thereof. They can be furnished with or without bolt and rivet holes.

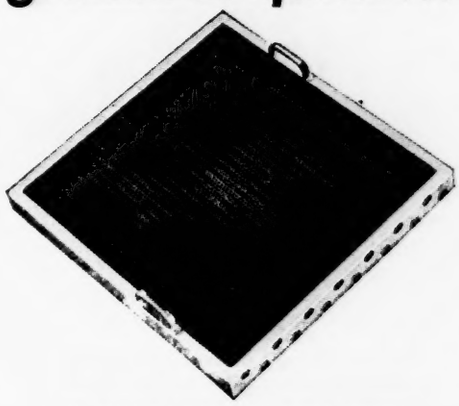
Tees, Bars, Channels and special shapes can also be rolled in the same expert manner to your specifications.

Angle Rings are used for many purposes such as reinforcing tanks, joining pipe or smoke stacks, and installing air conditioning fans. Write for our list of standard sizes and discounts—also our new circular just off the press.

NATIONAL METAL FABRICATORS
2138 S. SAWYER AVE. CHICAGO 23, ILL.

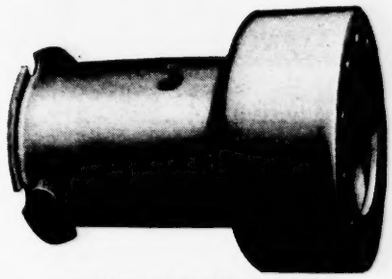
As advertised in TIME and NEWSWEEK

From capturing grease droplets...



Air-Maze Greastop filter panels prevent fire hazards in kitchen ventilating systems.

to hushing air for superchargers...



Air-Maze in-line silencers quiet intake noise on supercharged engines.

put your problem up to Air-Maze!

To keep fire-causing grease droplets out of commercial kitchen ventilating systems is one problem—to blanket out undesirable air intake noise on supercharged engines is another. But both jobs involve air. And there's a special Air-Maze product *engineered* to solve each of them—just as there are Air-Maze filters designed to solve scores of filtration problems involving air or liquids.

WHAT'S YOUR FILTERING PROBLEM? Whether you build or use engines, compressors, hydraulic equipment, lubricating or ventilating systems, *or any device using air or liquids*—the chances are there is an Air-Maze *engineered* filter to serve you better. Write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE
The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

EXCLUSIVE ILG SELF-COOLED MOTOR NEVER "SLOW-ROASTS"

10 SALES CLINCHERS!

ILG UNIT HEATERS

4 TYPES . . . 18 CAPACITIES

1. EXCLUSIVE ILG SELF-COOLED MOTOR—No "slow-roasting" of motor due to radiated heat from core. Saves power cost.
2. TWO-PIECE GRADUATED HEADER—Gives you "Balanced" steam distribution . . . each tube expands and contracts uniformly.
3. TOP OF HEADER—Bolted on, using gasket tested by 60 years of steam practice . . . simplifies maintenance.
4. BRASS ORIFICE BUSHINGS—Expand tubes uniformly in header plate.
5. SOLID COPPER CORE—26 gauge flanged copper fins pressed onto ½" O. D. copper round tubes.
6. BOTTOM HEADER—"Floats" on slotted coil retainer and spring washers . . . permits expansion and contraction of coil independent of unit casing.
7. DYNAMIC HEAT DISTRIBUTION—Individually adjustable louvers lessen air turbulence and increase heating range.
8. SAFETY SUSPENSION—Sturdy eyebolts, connected directly to rugged cast-iron header, remove all weight from supply line.
9. DYNAMICALLY BALANCED FAN WHEEL—Specially designed for ILG Unit Heaters. Verified for dynamic balance at rated speeds.
10. "ONE-NAME-PLATE" RESPONSIBILITY—Each ILG Unit Heater is made, tested, sold and guaranteed as a complete unit.

ILG ELECTRIC VENTILATING CO.,
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☐ Send Free copy of New Unit Heater Bulletin No. 342.

Firm Name.....

Your Name ..... Title.....

Address ..... Zone.....

City..... State.....

News of the Month

The housing and Home Finance Agency has agreed to encourage wider use of modular coordination, and the Joint Housing Committee of Congress has singled out the project as a means of cost reduction.

• Production of *coke from coal gas* retorts in the United States in 1947 declined 12% from 1946 and totaled 664,576 tons. This decrease was the result of substitution of water-gas, natural gas, and liquefied petroleum gas for coal gas at a number of installations. There has been a definite acceleration of such conversions since the war.

• The Ventilating and Air Conditioning Contractors' Association of Chicago has established an annual *award for superior apprentice training* throughout the industry. Both the Joint Apprentice Training Committee and the individual apprentice participate in the award. For superior accomplishment in selecting apprentices and in selling apprenticeship to employers the winning committee will be awarded the Association's bronze trophy for a period of one year. Individual apprentice awards are based on the performance of any regular apprentice whose second year of training is principally within the calendar year of the award. Three annual cash prizes of $100, $75, and $50 will be awarded individual apprentices.

• Fifty representatives from thirty different companies and organizations attended the twentieth anniversary meeting of the *Steel Boiler Institute* at Hershey, Pennsylvania, May 10-11. Newly elected to the Board of Directors of the Institute is E. I. Boardman, vice-president, Spencer Heater Division, Avco Manufacturing Corp., Williamsport, Pa.

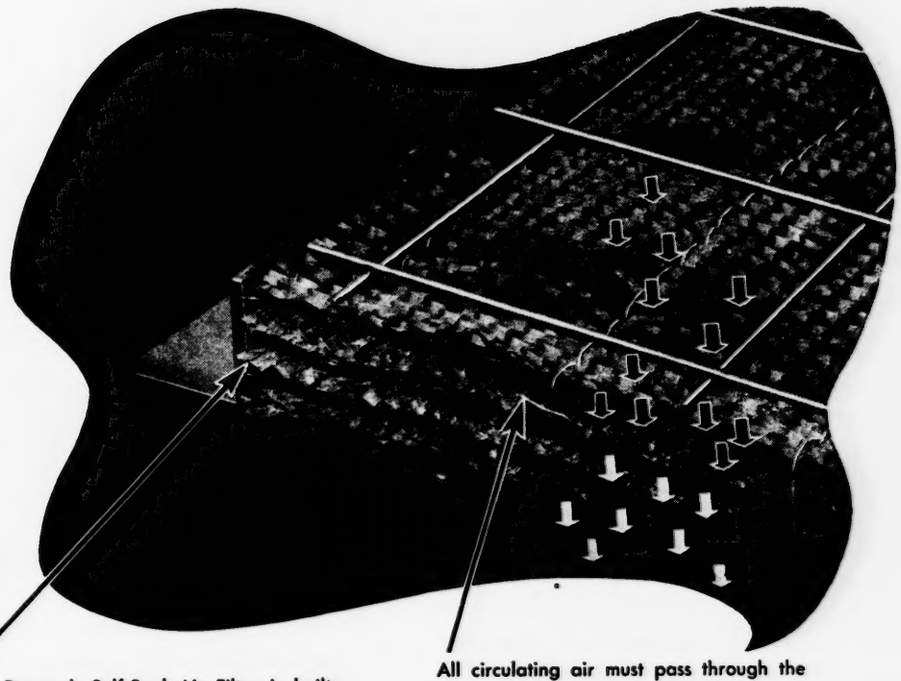
• *Enough water is pumped out of active anthracite mine workings* each year to create a body of water the size of Lake Tahoe in California and Nevada. About 1,821,000 tons of water daily are removed from anthracite mine workings. The average mine pumps about 13 tons of water for every ton of anthracite mined and some move as much as 45 tons of water for each ton of anthracite. Twenty-five years ago the ratio of water pumped to anthracite extracted was 8 to 1.

• The Underwriting Division of the Federal Housing Administration has issued standards accepting *aluminum tubing* or standard IPS aluminum pipe for use in vent pipes in plumbing systems.

• Nearly *one and a half million dollars have been spent on research* by the American Gas Association in the past three years.

• The Department of Commerce is planning to conduct a voluntary agreement to provide *212,000 tons of steel for the manufacture of warm air heating equipment* for residential housing during the six months ending February 28, 1949.

IN AIR FILTERING THE *Self-Seal Edge* MAKES A DIFFERENCE



The Research Self-Seal Air Filter is built slightly over size, and fits snugly into the holding frame with a self-sealing edge that absolutely prevents any bypass of unfiltered air.

All circulating air must pass through the filter media, where thousands of tiny baffles cause a turbulent action in the air stream, and effectively scrub out dirt, dust, lint and pollen.

RESEARCH *Self-Seal* AIR FILTERS

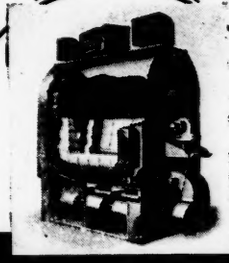
MANUFACTURED BY RESEARCH PRODUCTS CORP., MADISON 10, WISCONSIN

LEE

PIONEERS OF

DIRECT FIRED WARM AIR HEATERS

Heat Where Needed — FOLLOW THE HEAT — DEMAND CURVE OF YOUR BUILDING — Heat When Needed



COUNTER-FLOW

Easy to Install

- Completely automatic with any fuel
- 80—85% efficient
- No licensed fireman

Easy to Maintain

- Floor, wall or roof mounted
- Instant pick-up from cold start
- Easy conversion to any fuel
- Ventilation in summer

- Capacities of 300,000 Btu to 8,000,000 Btu in single unit

Write for Bulletin No. 101

(Representatives Wanted)

LEE ENGINEERING COMPANY

95 RIVER STREET, HOBOKEN, NEW JERSEY

(Formerly Youngstown, Ohio)

Facts 'n Figures—

on the *high* quality, *low* cost

★ All bronze—stainless steel shaft.
★ Pressures up to 80 lbs.—raises city pressure 80 lbs.
★ Delivers up to 8 GPM.
★ Speeds from 1000 to 2200 RPM.
★ Long life—rugged construction, only one moving part, double ball bearings.
★ Weighs only 12 lbs.—suitable for horsepower ratings up to ¾.

Pump only ..... list price **$35.00**
Pump with 3" O.D. V-Groove sheave ..... list price **36.50**
Pump with base and coupling ..... list price **40.00**

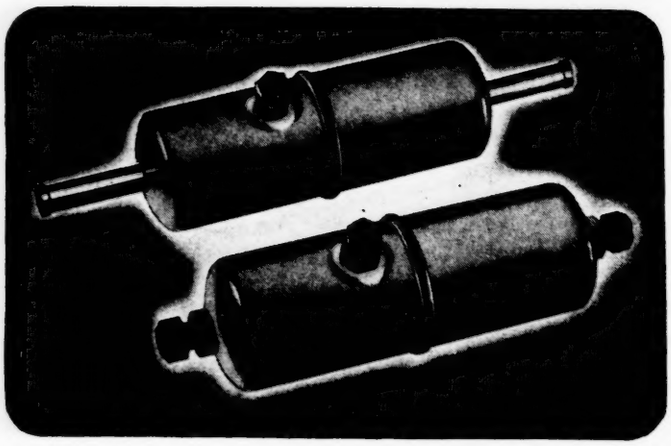
ROY E. ROTH CO., 2476 Fourth Ave., Rock Island, Ill.

ROTH PUMPS

NOW... Keep Larger Systems Moisture-Free, Dirt-Free ...

Install New Large-Capacity, Rechargeable

TRAP-DRI DRIER FILTER STRAINER

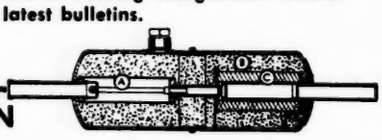


● With a rating up to 5 tons Freon these new larger A-P TRAP-DRI Drier-Filter-Strainers give you a welcome "break" on cleaning out larger systems, as well as providing for those small systems which need a larger capacity drier for preliminary cleanout. Now all your systems up to 5 tons Freon may be given the *extra protection* that means so much to improved system efficiency, avoidance of common troubles and service difficulties due to moisture, dirt, solder particles, scale, sludge and other impurities.

The new larger A-P TRAP-DRI starts cleaning up your system immediately. Offering *minimum pressure drop*, it provides a filter unit as effective as a 900-mesh strainer (removing materials as small as 5 microns in size) . . . *plus* a highly-efficient and adequate charge of Silica Gel —53.7 cubic inches. This *drying agent may be removed and replaced, or dried out and re-used.*

Install the new A-P TRAP-DRI in your larger refrigeration systems — for improved operation, savings in service time, greater satisfaction and cost-savings for your customers. You'll find them at leading refrigeration wholesalers — or write for latest bulletins.

VERSATILITY IN INSTALLATION



The new TRAP-DRI is supplied in two types: Model DF-4, with ½" male flare; or DS-5, with ⅜" sweat connection. They may be easily connected to ⅜", ½", ⅝", ¾" or even ⅞" tubing if desired. This ready versatility makes the new TRAP-DRI adaptable to a wide variety of systems.

Cross Section showing:
(A) Screen at inlet diffuses refrigerant into Silica Gel.
(B) Silica Gel drying agent (53.7 cu. in.)
(C) Honeycomb filter element traps impurities as small as 5 microns, by depth filtration principle.

AUTOMATIC PRODUCTS COMPANY
2462 North Thirty-Second Street
Milwaukee 10, Wisconsin
Export Dept., 13 East 40th Street, New York 16, N. Y.

R704

A-P DEPENDABLE REFRIGERANT VALVES

STOCKED AND SOLD BY GOOD REFRIGERATION WHOLESALERS . . . RECOMMENDED AND INSTALLED BY LEADING REFRIGERATION SERVICE ENGINEERS

CANADIAN DEGREE-DAYS FOR MAY, 1948*

City	May 1948†	May Normal	Cumulative, Sept. 1 to May 31 1947-48	Cumulative, Sept. 1 to May 31 Normal
Calgary, Alta.	465	480	9596	9111
Charlottetown, P. E. I.	533	536	8629	8263
Crescent Valley, B. C.	365	403	7304	7731
Edmonton, Alta.	338	428	10,141	9797
Fort William, Ont.	536	567	10,277	10,045
Grande Prairie, Alta.	341	505	10,493	10,122
Halifax, N. S.	576	493	7635	7395
London, Ont.	382	307	7547	7275
Medicine Hat, Alta.	285	301	8822	8495
Moncton, N. B.	499	474	8884	8568
Montreal, P. Q.	355	325	8452	8413
North Bay, Ont.	513	434	9647	9180
Ottawa, Ont.	367	310	8673	8674
Penticton, B. C.	316	273	6340	6346
Porquis Junction, Ont.	609	558	10,793	11,144
Prince George, B. C.	370	490	9072	8996
Quebec City, P. Q.	390	428	8966	9276
Regina, Sask.	335	434	11,147	10,891
St. John, N. B.	539	505	8218	8081
Saskatoon, Sask.	321	397	11,301	10,478
Toronto, Ont.	353	341	6933	7236
Vancouver, B. C.	378	326	5490	5303
Victoria, B. C.	367	366	4993	4935
Windsor, Ont.	314	251	6659	6705
Winnipeg, Man.	348	397	10,861	10,841

*These data are supplied through the courtesy of the Meteorological Division, Air Services Branch, Department of Transport, Canada, with the cooperation of N. W. Etter, Heating Engineer, Enamel & Heating Products Limited, Sackville, N. B.

†These figures were not available at the time last month's issue went to press.

WHAT READERS SAY

The Heat Pump

EDITOR, HEATING AND VENTILATING:

The article "Heating by Electricity in the Tennessee Valley Area," HEATING AND VENTILATING, May, 1948, gives some operating data on the heat pump which may be very confusing. I am particularly referring to the performance coefficient given in Table 3 of the article.

The performance coefficient given in Table 3 is based on the heating requirements of the residence. The coefficient of performance of a heat pump during the heating cycle is based on the heating capacity of the machine itself and in no way is connected with the heating requirement of the structure. The coefficient of performance is the heating output of a machine or system divided by the heat equivalent of the work input.

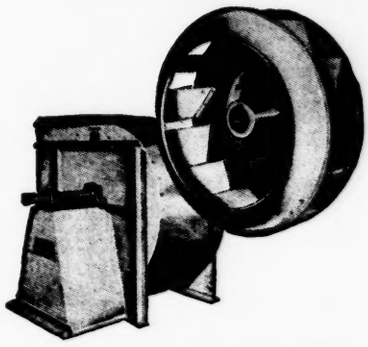
It is incorrect to base the performance of a heat pump system on the heating requirements of the structure because of the many variables involved in computing the heat loss. The coefficients of heat transfer through walls, roof, floors, etc., (normally used as given in the ASHVE *Guide*) are all based on a wind velocity of 15 mph and do not include sun effect or heat storage effect of the structure. The wind velocity as well as the sun and storage effects are all quite variable and are very difficult to determine and yet they all materially affect the heating requirements of the structure. The performance given in Table 3 (erroneously called the coefficient of performance) credits the heat received from the sun and the heat

BETTER
Flexible
METAL HOSE
FOR EVERY PURPOSE

• SEAMLESS—Constructed from one continuous piece of uniform thickness • PARALLEL CORRUGATION assures maximum strength and flexibility • SPECIAL ALLOYS provide resistance to heat, acid, etc., depending on requirements • AVAILABLE in wide variety of types to convey all kinds of liquids and gases • AVAILABLE in complete form as vibration reducers for Air Conditioning and Refrigeration Units.

Write Eclipse-Pioneer for information.

ECLIPSE-PIONEER Division of Bendix AVIATION CORPORATION
TETERBORO, NEW JERSEY



MASSACHUSETTS
POWER FIXED FANS
DESIGN 4
• AIR CONDITIONING •
HEATING &
VENTILATING
• INDUSTRIAL •

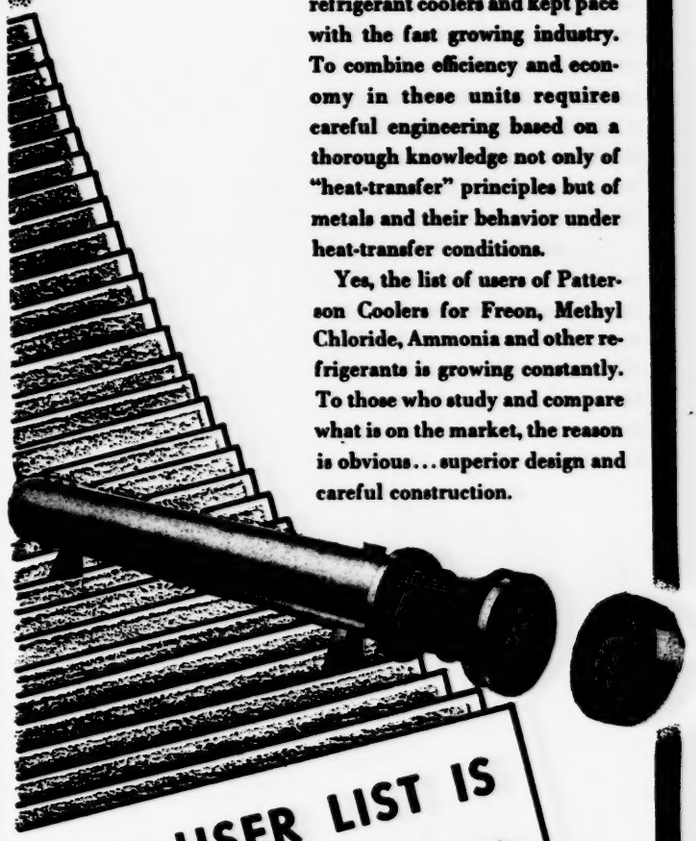
Write for Bulletin 101 Catalog

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE CLEVELAND 14, OHIO

Coolers
... by PATTERSON-KELLEY

Being "heat-transfer" specialists, it is only natural that long ago our engineers began to work on refrigerant coolers and kept pace with the fast growing industry. To combine efficiency and economy in these units requires careful engineering based on a thorough knowledge not only of "heat-transfer" principles but of metals and their behavior under heat-transfer conditions.

Yes, the list of users of Patterson Coolers for Freon, Methyl Chloride, Ammonia and other refrigerants is growing constantly. To those who study and compare what is on the market, the reason is obvious... superior design and careful construction.



THE USER LIST IS GROWING LONGER ... RAPIDLY

Write for new bulletin which describes the latest type of Patterson Dry Expansion Type Cooler illustrated above. You will be interested, for example, in the refrigerant chamber which is machined from a solid billet of rolled carbon steel with welded-in partitions.

THE PATTERSON-KELLEY Company, Inc.
122 WARREN STREET, EAST STROUDSBURG, PA.
NEW YORK 17—101 Park Ave. PHILADELPHIA 3—1700 Walnut St.
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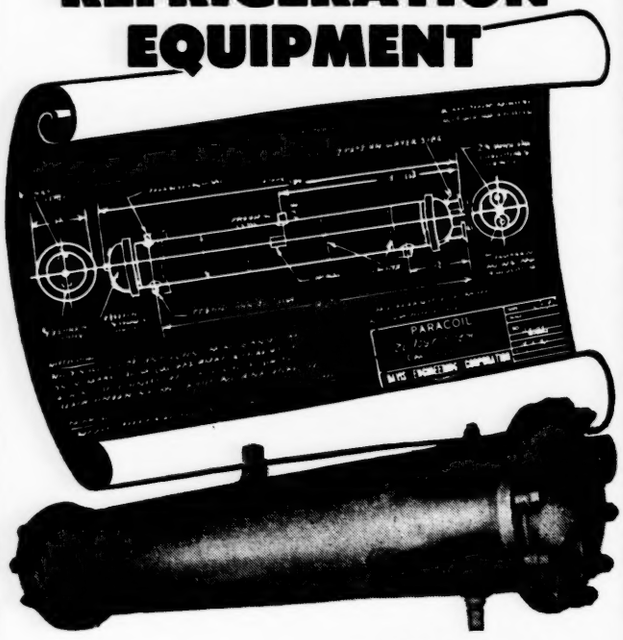
AIR CONDITIONING and REFRIGERATION EQUIPMENT



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loss reduction due to lower wind velocities and storage effect of the structure to the heat pumps. This, of course, is not correct.

In calculating the coefficient of performance, it is necessary to know the heat output of the machine or system and the heat equivalent of the work input all in Btu per hr. The true coefficient of performance, I am sure, will be appreciably lower than that indicated in Table 3 and for this reason is misleading. Since it is very important to have accurate heat pump data circulated, I suggest that the above apparent errors be called to the author's attention so that he may have an opportunity to correct the tabulation.

E. R. Ambrose
Air Conditioning Engineer
American Gas and Electric Service Corp.
New York, N. Y.

EDITOR, HEATING AND VENTILATING:

In reply to the letter of Mr. E. R. Ambrose, American Gas and Electric Service Corporation, in which he commented upon the use of the term "performance coefficient" in connection with the data given in Table 3 of the article prepared by Mr. Newberry and me, which appeared in the May issue of HEATING AND VENTILATING. I appreciated every much the opportunity to review this letter and also to discuss the question raised by Mr. Ambrose.

Mr. Ambrose is quite correct in calling our hand on the use of the term "performance coefficient" as used in this table. Although very careful calculations had been prepared of the heat loss from the house under consideration, and intimate knowledge of the family's living habits were taken into consideration, the values given in the table are not true performance coefficients. I presume such a term as "coefficient of comparison" would be more nearly the correct usage. At the time the data were collected, from which this table was prepared, we did not have available a means of measuring the heat output of the Marvair unit; however, during the winter season of 1947-1948 a recording thermometer was installed to measure the temperature of the air going into the machine and the temperature at the discharge side of the plenum. Also, power input measurements were taken, from which a coefficient performance was calculated. I am tabulating below, the additional data from which a new coefficient of performance was derived:

Cross sectional are of air discharge bonnet	3.44 sq ft
Average air velocity in discharge bonnet (Measurements taken with an air flow meter)	380 ft per sec.
Average air discharged through the bonnet	1,320 cfm
Average air temperature in discharge bonnet	101.2F.
Average air temperature in intake bonnet	70F.
Average air temperature difference through unit	31.2F.
Specific heat of air taken as	.018

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Reveals efficiency of combustion—tells how much money is going up the flue.

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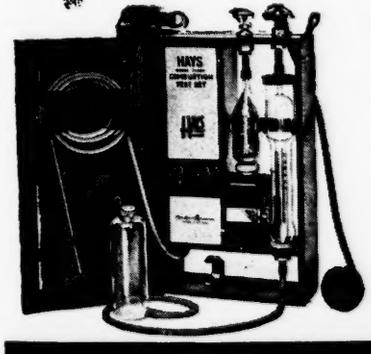

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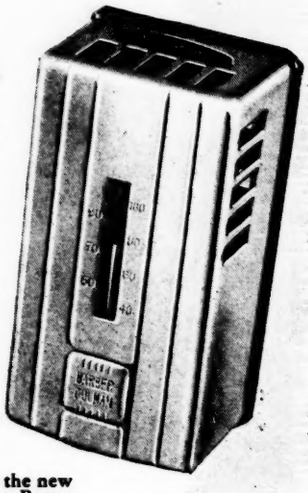
The new Room Thermostat is designed for pleasing proportions, smaller size, and unobtrusive appearance. Redesign of the operating elements, detents, adjusting mechanism, and contacts produces a more accurate, more sensitive, more durable control instrument. New cases also appear on the Microtherms, with corresponding improvements.



Shown here is the new Barber-Colman Room Thermostat. Case dimensions are 2" wide, 4" high, 1½" deep.

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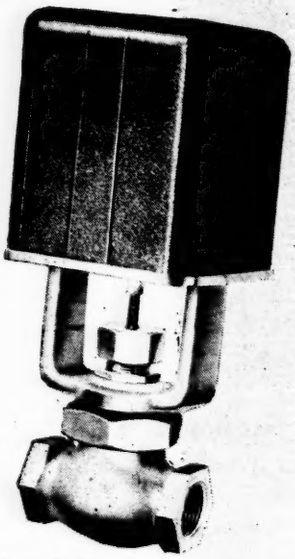

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Metered input of all motor-driven equipment, including compressor, fan and water-circulating pump motors ..... 3.05 kw

Coefficient of performance

$$= \frac{1{,}320 \times 31.2 \times .018 \times 60}{3.05 \times 3{,}413} = 4.27$$

Although data were not collected for the full heating season, it is believed that this information is sufficiently accurate to indicate that the particular heat pump under study had a coefficient performance of better than four. Also, it is of interest that the performance coefficient arrived at by the more accurate method so closely approximates the calculated value given in the table.

Buford H. Martin
Electrical Development Branch

Tennessee Valley Authority,
Chattanooga, Tenn.

NEW CATALOGS

Motor Selector

Information on Allis-Chalmers general purpose motors is contained in a new "Handy Guide for Quick Selection of Electric Motors." The 12-page bulletin provides detailed specifications covering squirrel-cage induction motors and application data, range of sizes and speed torque curves on synchronous, wound rotor and direct current motors. It covers applications and features of gearmotors and multi-speed induction motors and carries an induction motor selection chart for units from one to 200 hp. — *Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.* 144

Scrubbers and Coolers

A three-color bulletin, No. H-203, on gas scrubbers and coolers presents diagrammatic sections and illustrations explaining both the multi-stage and single-stage scrubber and cooler. Bulletin also carries diagrams of the Peabody impingement baffle-plate action. —*Peabody Engineering Corp., 580 Fifth Ave., New York 19, N. Y.* 145

Fans and Blowers

A 16-page, 2-color catalog describes and illustrates the General Blower line of centrifugal and axial flow fans and blowers, roof ventilators, and specialized air handling equipment.—*General Blower Company, Morton Grove, Ill.* 146

Heat Transfer Products

Catalog No. 148 describes the Young line of convectors, unit heaters, air conditioning equipment, radiators, heat exchangers, cooling and condensing units and other heat transfer products.—*Young Radiator Co., Racine, Wis.* 147

Condensate Pump

Type UV condensate pumps and receivers are described in a 4-page bulletin, No. 19-A. Sizes, capacities, engineering data, and dimensions are included in a table.—*Skidmore Corp., St. Joseph, Mich.* **148**

Commercial Air Conditioners

The Worthington line of commercial air conditioners is described in a series of six looseleaf bulletins. Photographs, specifications, drawings, and physical data are included on each sheet. The series includes data on evaporative condensers, unit heaters and packaged air conditioners.—*Worthington Pump and Machinery Corp., Harrison, N. J.* **149**

Drives and Pulleys

Congress drives for light machinery are described in a 12-page bulletin, CD 300, with tables of pulley and belt prices and dimensions, flexible coupling data, and belt construction. — *Congress Drives Division, Tann Corporation, 3750 E. Outer Drive, Detroit 12, Mich.* **150**

Valves and Fittings

An 80-page catalog gives complete information on the Cooper line of corrosion-resisting stainless steel valves, fittings and accessories. A tab-indexing system helps the reader to obtain information on prices, dimensions, finished weights, etc. Catalog is bound with a plastic binding with a heavy cover.—*The Cooper Alloy Foundry Co., Hillside 5, N. J.* **151**

Corrosion Control

A 4-page folder describes and illustrates how Prufcoat coating protects machinery and structures against corrosion from acids, alkalies, oil, and water.—*Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.* **152**

AUGUST, 1948

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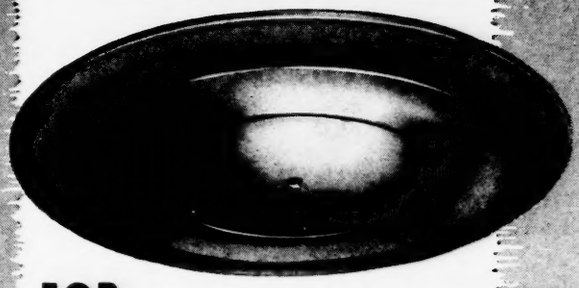
Engineered Air Distribution

venturi-flo

CEILING OUTLETS



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The VENTURI-FLO air outlet has flow characteristics similar to those of the well-known fluid measuring device — the Venturi meter. The relationship between the neck area of the unit proper and the venturi throat area is so proportioned as to create a slight back pressure in the neck at all times, thereby automatically assuring uniform distribution around the entire periphery of the unit.

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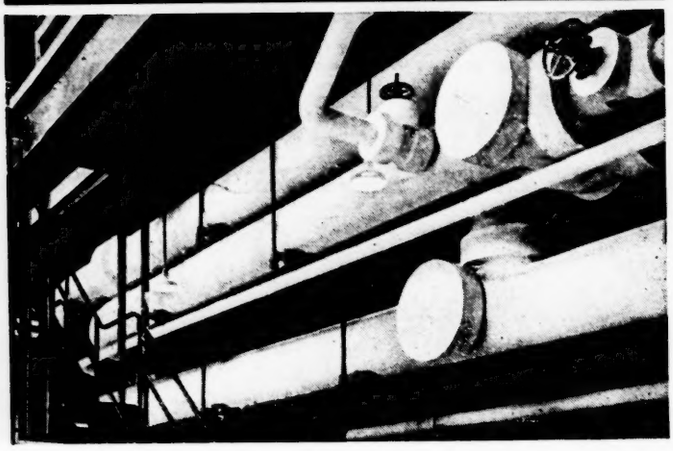

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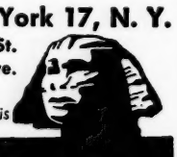

Adhesives?... ARABOL!

Getting Personal

E. J. Kurek

E. J. Kurek *(Air Conditioning Long Distance Buses,* page 65) attended the Illinois Institute of Technology as a co-operative student and later under the Navy College Training Program. He received his Bachelor of Science Degree in Mechanical Engineering in 1944. Upon being commissioned in the Naval Reserve he was assigned to destroyer duty and at the time of separation to inactive duty was the engineer officer of the U.S.S. Cowell.

Subsequently connected with the mechanical press manufacturing program of the Danly Machine Specialties Co., Inc., he left in early 1947 to join in the development of experimental coaches for The Greyhound Corp. At present he does design, equipment specification, and project engineering of air conditioning systems in the experimental program.

H. A. Erickson

Henry A. Erickson *(Analysis of Low Pressure Steam Piping System Construction Costs,* page 78) was born in Kansas City, Mo., and was educated in California and New York. He has been associated with the heating and piping contracting business for over 35 years.

In 1928 he was in charge of the heating and piping division of the Bureau of Quantity Surveys, Inc., Baltimore, Md., an organization that was engaged in making and furnishing material and labor surveys to heating, piping, plumbing and electrical contractors. Due to economic conditions, the Bureau was discontinued in 1931. Since that time he continued in quantity survey work, both in the east and west.

Mr. Erickson retired a few months ago and at present is residing in Burbank, Calif.

Austin J. Maher *(Building Shape vs. Heating Efficiency,* page 91) has had wide engineering experience. He was formerly associated with the Maneflow Regulator Co., New York Central Railroad, Thomas E. Murray Co., Inc., United Electric Light and Power Co. At present he is in civil service.

C. W. Brown

Coy W. Brown, engineer, *(Personal Weather System for Air Conditioning Multi-Story Buildings,* page 89) Application Engineering Division, General Electric Company's Air Conditioning Department at Bloomfield, N. J., has participated in the engineering of some of the country's outstanding air conditioning installations. Most notable was his work in 1939 and 1940 on the air conditioning system for the huge Walt Disney Studios in California.

Mr. Brown was graduated from Oregon State College in 1930 with the degree of B.S. in Mechanical Engineering, and, that same year, joined the General Electric Co. at Schenectady, N. Y. Since that time,

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THE ALL-AROUND ECONOMICAL GENERAL UTILITY CENTRIFUGAL PUMP

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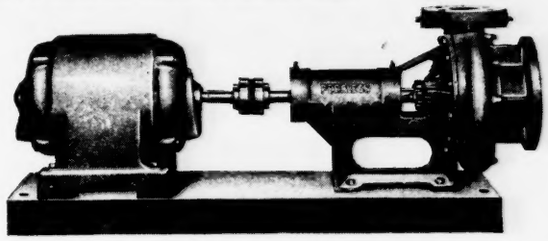

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The versatile Peerless Fluidyne is pumping simplicity at its best. Peerless FLUIDYNE Type PE (Electric drive unit) or the Type PB (direct connected. V-belt or flat belt drive unit) are designed for vertical, horizontal or intermediate angle installations, with consistent and dependable high efficiency operation. *Completely described in Bulletin B-165.*

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¼ to 1 HP
CAPACITIES: *10 to 50 GPM.*
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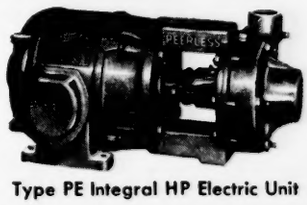
Possessing all characteristics of the Types PE and PB pumps described above, these fractional Fluidyne Peerless Pumps may be coupled to motor for incorporation into any system requiring forced liquid circulation. All Fluidyne pumps are of end suction, single stage design with vertical split casing joint, and embody a host of features for ease of accessibility and maintenance. *Completely described in Bulletins B-150 and B-151.*



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Fluidyne flexibility is readily adaptable as an integral part of equipment and system sub-assemblies in processing, refrigeration, air conditioning equipment, etc.

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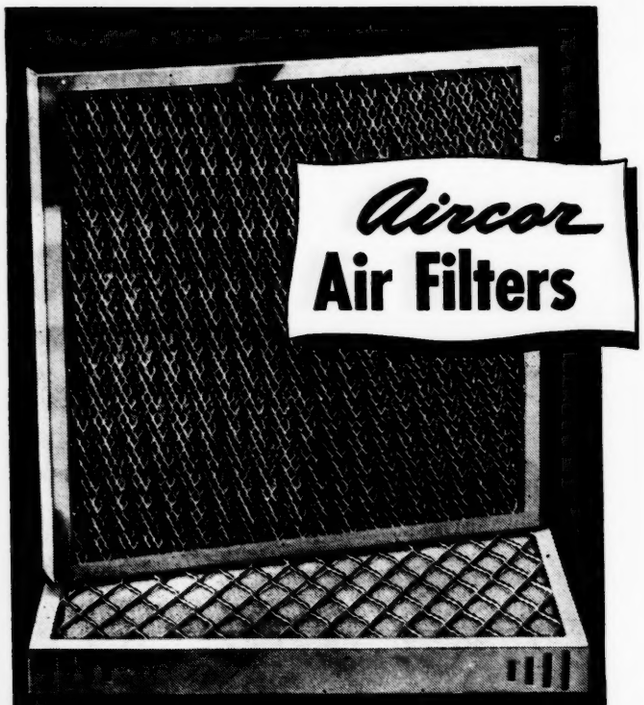

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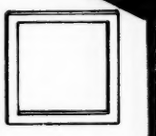

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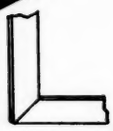

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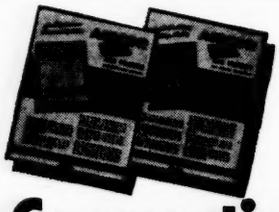

Air Filter Corporation

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DOUGLAS ENGINEERING CO., LTD. MONTREAL

he has served in various engineering capacities in San Francisco, Cleveland and New York. While with the air conditioning department, he has served as a field engineer and most recently was placed in charge of application engineering for this G. E. department.

R. A. Lawder

Robert A. Lawder *(Adequate Temperature Controls Provide Improved Apartment House Heating,* page 85), born in Wakefield, Mass., attended high school in Fall River, Mass., and was graduated from Brown University in 1919.

In 1931 he joined the heating division of Consolidated Gas Co. and later became sales promotion manager with emphasis on activities in the gas heating field.

Mr. Lawder joined the Minneapolis-Honeywell Regulator Company in 1944. In his assignment in the Personalized Heating Controls Division of Honeywell he has helped to design automatic heating control systems for some of the major apartment houses constructed in the New York area since the war.

. . . Since the Last Issue

Two additional sales representatives for **L. J. Wing Mfg. Co.** in Canada have been announced. **J. C. Davis Ltd.** of Winnipeg will represent Wing heating, ventilating, and combustion products in Manitoba, Saskatchewan, and Alberta, and **Control Equipment Co.** of Toronto will represent Wing in Ontario. Preston, Phipps of Montreal will continue their representation in the province of Quebec with manufacturing operations conducted from Montreal.

Appointment of the **Western Appliance Corp.**, Denver, Col., as a Duo-Therm distributor has been announced by **Duo-Therm Division of Motor Wheel Corp.**, Lansing, Mich.

A training school for technicians and apprentice mechanics from branch offices, and June graduates in mechanical engineering from various colleges is being conducted by **Johnson Service Co.**, Milwaukee, manufacturers of automatic temperature controls. Under the direction of J. R. Vernon, sales promotion manager, the course continues through August 13, and is divided into three sections: Automatic control apparatus, under **H. W. Alyea**, field and development engineer; heating and air conditioning systems, under **M. M. Herrick**, application engineer; and sales and contracting operation for those in sales activities only, under **J. R. Vernon**. Other lecturers include **C. A. Otto**, chief engineer, Milwaukee; **A. J. Otto**, factory superintendent, Milwaukee; **R. A. Thompson**, production manager, Milwaukee; **O. G. Ward**, vice-president and district manager, Chicago; **Albert Schoebel**, construction superintendent, Milwaukee.

Robert E. Rielly, with **The Schaible Co.**, Cincinnati, Ohio, since March 1947, has been appointed advertising and sales promotion manager of the company.

Carroll M. Baumgardner has resigned as executive vice-president and member of the board of directors of **United States Radiator Corporation**, Detroit, Mich.

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A handy-size buyers' guide published annually by HEATING AND VENTILATING, listing the sources of supply for all types of products used in Air Conditioning, Heating, Ventilating, Piping and Refrigeration. It is distributed to Engineers and Contractors who use its listings and its advertising pages as a source of product data when designing, specifying and buying. It tells "who makes it" and "where to get it."

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(2) MANUFACTURERS' Listing, an alphabetical listing of firms manufacturing all the foregoing equipment, with complete address.

(3) TRADE NAME Listing, handy directory of trade names, current and obsolete, giving nature of product and manufacturer's name. And an entirely new and exclusive section in the 1949 Buyers' Directory—

(4) LOCAL REPRESENTATIVES' Listing (see next paragraph).

Listings of Local Representatives

One of the chief complaints of Equipment Buyers—their difficulty in locating the nearest Local Representative of a manufacturer when seeking information or placing orders—has been met by incorporating in the 1949 Buyers' Directory a new section in which manufacturers list their Branch Offices and Local Representatives geographically with street address and phone number. Much needless writing, wiring and phoning back and forth is eliminated—the Engineer or Contractor can refer to this list and make prompt contact with the representative nearest to him.

Directory Users say:

"The Buyers' Directory gives me a large listing of various products from which I can choose equipment from several makes for writing specifications."—"We find what we want, when we want it; this office would be lost without it."—"It has everything—in one book. Couldn't be better for me."—"We rarely refer to other buyers' guides."—"It is chock full of needed information and it's easy to find what you want."—"Saves time locating a particular item."

Handy Size

5⅝" x 8⅛". More than 300 pages.

Date of Publication

December, 1948.

Published by HEATING AND VENTILATING, 148 Lafayette Street, New York 13, N. Y.

Equipment Manufacturers:

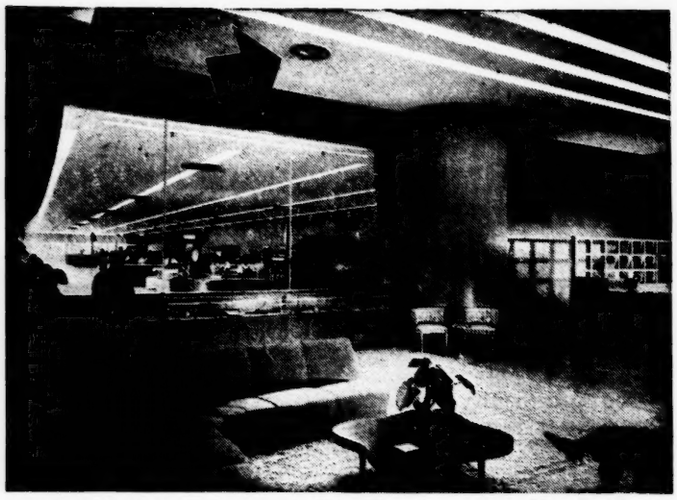
If you manufacture any equipment, parts or materials used in the field of Air Conditioning, Heating, Ventilating, Piping or Refrigeration—the advantages of having your advertisement in the BUYERS' DIRECTORY are obvious. For a full year your ad is at the fingertips of 10,000 Engineers and Contractors. And they're the men who design original equipment and also those who plan systems and install and maintain them, in industrial plants, office buildings, hospitals, hotels, theatres, stores, institutions, housing projects, etc. Advertising rates, distribution breakdown and other details gladly furnished.

You can likewise profit by listing your Local Representatives (full address and phone number of each) at only $1.00 per representative. Folder on request.

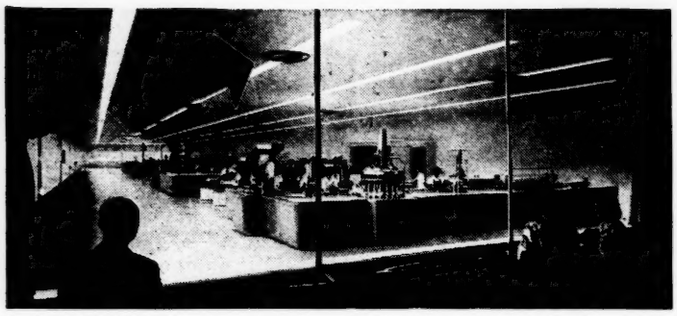
JOHNSON & JOHNSON
specifies
Kno-Draft Air Diffusers in New Plant

Picked for appearance and performance

ARCHITECTS, THE BALLINGER CO. • INDUSTRIAL DESIGNER, HERBERT ROSENGREN



APPEARANCE: Note the simplicity of design of the Kno-Draft Air Diffuser (arrow) in the reception room of the new Johnson & Johnson plant in Cranford, New Jersey. It enables these diffusers to blend with either modern or period interiors. In their original aluminum, Kno-Draft Diffusers furnish an unobtrusive decorative accent. Painted to match the ceiling, they become self-effacing.



PERFORMANCE: A close-up through the show window in the reception room discloses the manufacturing area of this modern plant. Those Kno-Draft Diffusers in the ceiling are delivering conditioned air in a pattern that eliminates drafts and maintains uniform temperature and humidity throughout the area. Since Kno-Draft Diffusers can be adjusted to control air direction, volume and throw, "custom-made" air patterns were created to meet the exacting requirements of product quality control and employee comfort established in this baby products plant.

Send for your FREE copy of our new handbook on air diffusion. It contains all the data to enable you to create "custom-made" air patterns and eliminate drafts. Please write Dept. E-15.

W. B. CONNOR ENGINEERING CORP.

Air Diffusion • Air Purification • Air Recovery

112 East 32nd Street — New York 16, N. Y.

IN CANADA: Douglas Engineering Co., Ltd., 190 Murray Street, Montreal 3, P. Q.

Richard A. Paris, formerly sales representative of the New England branch of the **Richmond Radiator Co.,** has been named assistant district sales manager for the area. Richmond Radiator has also appointed **Theodore R. Lewis** as sales engineer in their Washington District office.

J. A. Cutler, Milwaukee, has been appointed a member of the University of Wisconsin Athletic Board by President Edwin B. Fred of the University. Mr. Cutler is president of **Johnson Service Co.,** Milwaukee, and is a past president of the University of Wisconsin Alumni Association. He succeeds the late Justice Elmer Barlow of the Wisconsin Supreme Court. The board is composed of seven members —four faculty, one student, and two alumni. They are appointed by the president, subject to confirmation by the Board of Regent.

The Herman Nelson Corp., Moline, Ill., manufacturers of heating and ventilating products, announce that contracts have been signed for the erection of a new factory building to add 56,000 sq ft of additional working space. The building will be of one-story, steel construction and will serve as an addition to the large manufacturing plant built in 1945. The estimated cost of the building and equipment will be approximately $200,000.

McCord Corp. has announced the election of **W. G. Hancock** as president of the corporation. Mr. Hancock, previously vice-president in charge of operations, and a director, has been associated with the McCord Corp. for the past 29 years in various capacities. A. C. McCord for a considerable period has handled the offices of both chairman and president simultaneously. He will continue as the principal officer of the corporation.

W. G. Hancock

General Filters, Inc., Detroit, has announced the appointment of **Frank Gerlach** as factory representative for the New England territory comprising Massachusetts, Vermont, New Hampshire and Maine. He will make his headquarters at 61 Wellington Road, Manchester, Conn.

In the biggest move to date in its program of steady expansion, **Tube Turns, Inc.** has acquired the Pennsylvania Forge Corp. Announcement of the purchase was made by George O. Boomer, president of Tube Turns and its affiliate, The Girdler Corp. He will be chairman of the board of the Pennsylvania firm, manufacturers of flanges and custom forgings. James S. Kerwin, president, and W. T. J. Huggard, secretary and treasurer, and other officers will continue in their present capacities, and there will be no change in the personnel of the various departments. The business of the new subsidiary will continue to be operated under the name of the Pennsylvania Forge Corp., which occupies about 12½ acres on the Delaware River, in Tacony, a suburb of Philadelphia.

C. J. Gaspar, formerly assistant sales manager of the Nichols Wire and Aluminum Co., has been appointed sales manager of the **DeBothezat Fans Division of American Machine and Metals, Inc.,** East Moline, Ill., to take effect immediately.

George E. Roepke has been appointed sales representative of the Houston office of **Marlo Coil Co.,** St. Louis, Mo.

United States Radiator Corp. has announced the moving of its St. Louis branch office into new quarters in the Chouteau Building from its former location in the Arcade Building.

R. I. Parker of Chicago has been elected a commercial vice-president by the board of directors of the **General Electric Co.** Mr. Parker succeeded W. O. Batchelder, who retired after 42 years' service. With headquarters at Chicago, Mr. Parker will have charge of customer relations in Illinois, Michigan, Wisconsin, Minnesota, Iowa, Eastern Nebraska, Kansas, Missouri and Western Tennessee. A native of Kansas City and a graduate of the University of Kansas in 1912 with a B.S. degree in electrical engineering, Mr. Parker joined the General Electric Company as a student engineer on the Test Course at Schenectady.

R. I. Parker

Inland Steel Products Co., formerly Milcor Steel Company, announces the appointment of **Gordon W. Matthews** as jobber sales representative in the southeastern portion of the United States. His headquarters will be at Atlanta, Georgia.

William F. Hart, 65, of **The National Supply Co.**, who served as assistant to the chief of the industrial division of the Pittsburgh Ordnance District in World War II, died suddenly July 1 in a Cleveland hotel. He had been associated with National Supply since 1940.

Howard Marston, for the past 10 years sales and service engineer at the Boston branch of **Minneapolis-Honeywell Regulator Co.**, has been appointed industrial manager of the Brown division of the company in Minneapolis and St. Paul. **Earl S. Bush** has been named Chicago industrial sales engineer for the steel industry for the Brown division, succeeding A. J. Potts. **Larry E. Singleton** will succeed Mr. Bush as the Chicago branch industrial service manager.

S. R. Hirsch has been appointed executive engineer for **Worthington Pump and Machinery Corp.'s** Holyoke, Mass. works. In his new capacity, Mr. Hirsch will be in charge of engineering for a complete line of air conditioning and refrigeration equipment, the Blue Brute line of construction and mining equipment, the vertical line of stationery and farm compressors, and self-priming pumps.

John G. Seiler has been elected executive vice-president of **Tube Turns, Inc.**, Louisville, Ky. Mr. Seiler, who is a native of Louisville, became associated with Tube Turns on February 24, 1930. A year later he was appointed sales manager. He was made vice-president at the beginning of World War II, and general sales manager on February 14, 1945. Mr. Seiler is a member of the executive board of the American Supply and Machinery Manufacturers' Association; a member of the American Welding Society, Drop Forgings Association, Army Ordnance Association, International Acetylene Association, American Standards Association, and the American Society for Metals.

J. G. Seiler

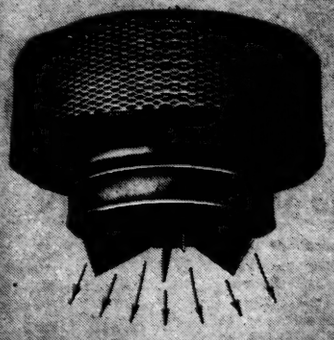
A reduction of approximately ten per cent in the price of Freon-22 fluorinated refrigerant has been announced by **Kinetic Chemicals, Inc.**

McCORD
HEATING AND AIR CONDITIONING PRODUCTS

BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

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